A BOOK OF RECENT EXPLORATION

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By

CHARLES E. KEY M.A. F.R.G.S.

AUTHOR OF
"A HISTORY OF THE BRITISH EMPIRE"
"THE STORY OF TWENTIETH-CENTURY EXPLORATION"

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PREFACE

> One question we naturally ask ourselves is, "What is left to the explorer to do? What areas still remain for his conquest?" To the layman there seems little left to be done. Man even has been able to look down on Everest. We seem a long way from the days when medieval geographers labelled large spaces of the earth with the ominous words "Here are griffins, hydras, and chimæras dire. . . ." I may say that we still have work for the explorer in Canada. I need not mention the British-Canadian Arctic expedition of 1936, and the party which surveyed the little-known coast of Ellesmere Land a year or two ago. The Government of Canada is happy to lend its co-operation in all such efforts. There is plenty of room for the adventurous in our north country and plenty of romance still to be found. In 1937 there was actually discovered, by accident, a new North-west Passage when the Hudson Bay steamer *Nascopie* on her annual voyage was surprised to meet a schooner in Bellot Strait coming from the opposite direction. The aeroplane is playing its part in exploration. A few years ago two of our scientists flew over the Magnetic North Pole, and over 770,000 square miles have been mapped from the air.
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> THE HON. VINCENT MASSEY, *in an address to the Royal Geographical Society, June* 26, 1939

IT seems clear that even in Canada we are a long way from writing the last chapter in the story of exploration. By an Order in Council of January 14, 1939, the Norwegian Government claimed sovereignty over a large stretch of Antarctica (from Coats Land to the boundary of the Australian Antarctic Territory), mainly as a consequence of the various expeditions undertaken by Lars Christensen since 1930. Yet there still remain thousands of square miles in Antarctica which have never been seen even from an aeroplane. Even the coastline of this huge continent is merely conjectural on the very latest maps of Enderby Land and Dronning Maud Land for instance. Similarly, our knowledge of the North Polar regions is limited to a few traverses with huge tracts of unknown country (or sea) intervening. Brazil and the Guianas are still in large part inadequately mapped. As late as August 1936 Captain Carington Smith was leading an official expedition to discover where the

frontier of British Guiana was, and two years later Paul Zahl was the first white man to see the tremendous waterfall on the Uitshi river (British Guiana), probably ten times as high as Niagara.

The Second World War delayed the writing of that last chapter still further. The development of aeroplane transport and other technical devices for photographic mapping and so on will, no doubt, benefit the cause of exploration immensely. In the reverse direction explorers have been able to help the war effort enormously—witness, for example, the invaluable work of Dr Sandford and Colonel Bagnold with the Long Range Desert Group in the Sahara. Indeed, it is rather strange how the war has turned into battlefields regions in Libya, New Guinea, and North Burma, which were not long ago the preserves of the explorers.

This book does not pretend to tell the whole story of recent exploration. It is rather a selection of the more significant or interesting expeditions described in terms such as the armchair geographer may follow. The maps are merely intended as sketch-maps or diagrams.

The chief sources of information have been the reports and lectures delivered from time to time by explorers to the Royal Geographical Society, though here and there reference has been made to books written by members of expeditions. Among the books which have been specially helpful I must mention *Southern Lights*, by J. Rymill (Chatto and Windus); *Half-mile Down*, by W. Beebe (John Lane, The Bodley Head); *On Top of the World*, by L. Brontman (Gollancz); *Blank on the Map*, by E. Shipton (Hodder and Stoughton); *Papuan Wonderland*, by J. Hides (Blackie); *Mid-ice*, by J. Georgi (K. Paul); *Black River of Tibet*, by J. Hanbury-Tracy (Frederick Muller); *Libyan Sands*, by R. Bagnold (Hodder and Stoughton); *Those Greenland Days*, by M. Lindsay (Penguin Books); *Sahara Unveiled*, by P. Turnbull (Hurst and Blackett); *Assam Adventure* and *Plant Hunter's Paradise*, by F. Kingdon Ward (Jonathan Cape).

For information, for illustrations, and for other help I must express my gratitude to Dr Roberts (of the Scott Polar Institute), to Squadron Leader Alfred Stephenson, to W. L. S. Fleming, Esq., to E. Shipton, Esq., and to F. Kingdon Ward, Esq.

C. E. K.

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THE FIRST CROSSING OF NEW GUINEA

ONLY ONE island in the whole world is larger than New Guinea. Fifteen hundred miles long and four hundred miles wide, New Guinea presents the explorer with some terrifying obstacles. Thousands of square miles are covered with equatorial forests, luxuriant in animal and plant life, through which crocodile-infested rivers writhe and flood. Here hostile head-hunters ambush unwanted visitors. Huge areas are covered with sago swamps, where the harassed wanderer—goaded by clouds of mosquitoes—must wade knee-deep in pools of evil-smelling slush. Near the coasts these difficulties can be avoided to a large extent by sailing or rafting along one of the great rivers, such as the Fly, the Sepik, or the Strickland, and so it is the river systems which are the best-known parts of the lowlands. But the interior is a rugged backbone of lofty mountains, forty to fifty miles across, which tower in places to 16,000 feet. These misty mountain chains are an even greater obstacle than the rain-forests. Pierced here and there by the gorges of mountain torrents, there stretches for hundreds of miles a gigantic escarpment—in places a sheer cliff 10,000 feet high. Moreover, most of this barrier consists of Karst limestone which has been cut by torrential rains into jagged ridges and deep potholes. In this nightmare region all surface water quickly soaks through the porous rock, and wide areas are as arid as a desert.

The primitive Papuans are still in the Stone Ages, and a steel tool is regarded as a priceless treasure worth a great deal of sago or taro. Those tribes which are in contact with Europeans are able to obtain some metal tools, but they often use them exactly as they do their own tools made of blue slate or greenstone. Thus plane-irons are very popular, but when obtained they are fixed into the usual haft made from a forked bough and used as an adze. Sometimes a spade is stolen—not to replace the primitive digging-stick, but to be cut up into strips to provide adze blades.

Many of the mountain tribes do not even know how to make pottery. Lengths of bamboo are used for cooking-pots, for carrying water, and even as drinking-vessels. One method of cooking is to roll the food in a length of bark and then place it in an open fire. The bamboo provides many natives with a pipe for smoking the home-grown tobacco, a stockade for the bamboo-thatched village, and jewel-cases for holding bone needles and ornaments. Young bamboo-shoots are considered a delicacy. A bamboo knife is sharp enough to cut up a wild pig or a cassowary. The Kukukuku tribes even make musical instruments from bamboo—a kind of Pan pipes, a Jew's harp, and a strange organ. This is a 40-foot bamboo with rectangular holes cut between the joints. The bamboo pole is set up in front of a house, and when the wind blows it gives out a tuneful medley of soft notes.

Tribal warfare is endemic, the chief fighting weapon being the stone-headed club. Club-heads vary in shape from tribe to tribe—some are ball-shaped, some star-shaped, and some pine-apple-shaped. The hole for the handle is made by dint of pecking away at both sides of the club-head with sharp stones. Bows and arrows are chiefly used for hunting, and quite often the bow-string is made from a piece of planed bamboo. Shields are commonly made from large slabs of wood and are painted in many patterns.

For food the New Guinea native relies chiefly on the various plants which he grows in his garden or which he collects in the bush. The gardens are rarely completely cleared, because felling a tree with stone weapons is a long and tedious business. Sweet potatoes, taro, yams, and bananas are the usual crops, and this diet is eked out with whatever scraps of meat are available—wild pig, wallaby, cassowary (a small variety of ostrich), lizards, snakes, or grubs. Birds are shot with the bow and arrow, and the feathers—especially of cockatoos or birds of paradise—used for ornamentation. In the interior salt is scarce, and sometimes the ashes of burnt plants are used as a substitute.

Until 1927 all efforts to cross New Guinea failed. In that year C. H. Karius, an assistant Resident Magistrate, was commissioned by the Lieutenant-Governor of Papua to lead an


EASTERN NEW GUINEA
0 50 100 150
MILES
THICK FORESTS
NORTH-EAST NEW GUINEA
Wewak
R. Sepik
CENTRAL RANGE
Madang
NEW BRITAIN
R. Strickland
R. Wahgi
LAE
SALAMAUA PENINSULA
THICK FORESTS
R. Bamu
Kikori
Morobe
R. Fly
Merauke
THICK FORESTS
GULF OF PAPUA
Buna
Kokoda
Tufi
Daru
PORT MORESBY
Rigo
Abau

expedition which was to trace the Fly to its source, cross to the head of the Sepik, and follow that great river to its mouth, thus crossing New Guinea in its widest part. The Government ketch *Elevala* carried Karius and his companion, Ivan Champion, a police officer, as far as the junction of the Alice tributary, about 500 miles from the mouth of the river Fly. Near by a base camp was constructed and the carriers (some of whom were local natives) and native police began the task of unloading equipment and the 40-lb. bags of rice. One carrier can carry just one of these bags, and in it there is sufficient food for himself for one month. Thus it was imperative that somewhere along the route to the mountains further supplies of food should be obtained. The expedition carried supplies of salt to exchange for native foods, and a good stock of knives and tomahawks.

On New Year's Day 1927 Karius set off for the Black river, sixty miles away, with seventy-five carriers. Before two days had passed, however, the local carriers deserted, and the next day twenty-seven of the other carriers deserted from the base camp. For the next month stores were transferred from camp to camp chiefly by bushmen until a sergeant of police walked into camp with the deserters, who had been intercepted. At last, after struggling across flooded streams and through dense bush for many days, they had advanced a hundred miles and were faced by the limestone barrier. They soon found it impossible to follow the river, as it ran through a gorge miles long and with walls rising sheer in places for several hundred feet. Champion made an effort to follow the right bank, his native police cutting a track through the tangled growth. Soon they came to limestone fissures, and it was desperate work climbing over sharp and brittle rocks where a false step meant a fall on to rapier-like pinnacles. On reaching the top of a ridge they found they had to crawl down into a basin beyond and then seek their way out again. There was neither water nor soil. That night they pitched a tent on a tiny beach between the turbulent stream and the limestone cliffs, and next day pushed on a little farther, only to find themselves faced by a wall of limestone beyond which they could not go. Champion's men built two small rafts, and they set off back down the river. Soon they plunged into a narrow gorge where the lime-

stone walls almost touched and where the branches of trees criss-crossing above them formed a gloomy tunnel. Faster and faster they bumped along, shot a rapid, and then swept out into the stream close beside the camp. It had taken just half an hour to return while the upward journey had taken fourteen hours.

It was decided to follow a small tributary to the east, and soon a native path leading to the slopes of Mount Blücher was discovered. From a spur where there was a native house they saw for the first time the ocean of level forest trees through which they had been struggling for months. It seemed at first that the sheer walls thousands of feet high beyond this would prevent any further exploration, but by persistent efforts Karius eventually found a way round Mount Blücher and then was excited by the discovery of a river on the northern side which he hoped would lead him to the Sepik. Since the journey had by this time lasted six months, and many of the carriers were feeling the effects of their thousand miles of travel, Karius decided to make a dash for the Sepik with a select party, while Champion was to take the remainder back to Daru. Actually Karius almost succeeded, for he had reached the head of a long valley leading northward when lack of supplies forced him to return to Daru via the Strickland. He had a trying journey because at one place the sides of the mountains had been shaken by earthquakes, and landslides came crashing down both night and day. Once a mountain-side began to move under their very feet, and they had barely passed before it crashed into a valley a thousand feet below.

Meanwhile Champion, naturally disappointed that he could not accompany his chief, had decided to see as much of the mountains as he could before returning with the carriers. Karius had gone to the north-east, but to the north-west there were unknown ranges and valleys, and a large branch of the river seemed to come from that direction. As it turned out Champion's enterprise proved most fortunate, for he not only found the source of one river but met some friendly natives who led him beneath the perpendicular walls of the Dap Range to the Bol (another headwater of the Fly) and so to a native village called Bolivip.

Soon Champion and his men were surrounded by excited natives yelling "Seno" (a peace word) and embracing them like long-lost brothers. They were madly excited when they saw how steel tomahawks could chop trees, and dashed about hacking at every shrub in reach until the path was blocked. Altogether there were over thirty houses thronged with men, women, and children. Suddenly the crowd parted, and a short, stocky man, with black twinkling eyes and wearing the usual cassowary plumes, stepped forward. The chief hugged Champion, and then, banging his chest with his open palm, made a sweeping flourish which included all the countryside; then he stooped and struck the ground, exclaiming loudly, "Bolivip! Bolivip!"

Introductions thus accomplished, the chief ordered his people to supply the visitors with baked taro, and then by means of signs told the explorer that the Bol river joined the "Feneng," which flowed to the south. Thus Champion learned that the river he had been following was only a tributary of the Fly, and not the longed-for route to the Sepik. The chief and his people made a great fuss of their visitors, and they were free to go anywhere except into one house, about thirty feet long. The entrance to this building was closed by flat boards, on which a design had been painted with red and blue pigment. Some of Champion's carriers started to erect a tent near this house, but they were stopped and asked to go elsewhere. The chief, by way of explanation, leaned over and whispered, "Amawk"—a word which he endeavoured to make intelligible by indicating that this was a feasting-house for the men before they went off to fight their enemies, the Faiwol people. Probably the house was taboo to the strangers because it contained gruesome relics of past victories. The chief also presented a boy with a very light skin and explained in pantomime that this boy had been found by a hunting party, that he had no mother and that, like the white man, he had dropped from the sky! The boy was presumably an albino. Apparently the natives of Bolivip had not been aware that white men existed.

The next day the chief led Champion to the Feneng, or Fly, and at last the explorer was able to obtain some information about the country to the north of the mountains. Apparently

the people there were called the Kelefomin, and they lived beside the river Takin, which flowed north! This was just the information Champion needed. The Takin was certainly one of the headwaters of the Sepik, and now he knew the name it might be possible to persuade some native to guide him to it. Champion decided to return at once to the base camp for supplies, and then if the carriers were fit to make an effort to reach the Takin. But by the time he had reached the base the carriers were footsore, and scarcely half a dozen were fit for work. One of the men had pleurisy and had to be carried. So Champion had to return home just as Karius had done. On June 11 he reached a point where it was possible to build rafts and start off down river.

Two miles from the starting-point the river curled round a high wall of limestone, opposite which was a shingle beach. Champion hoped that the rafts would be able to steer to this beach, but he found this was impossible, and the raft crashed into the wall. One of the native policemen pushed the raft off before it could sink, and soon they had gained the beach. The next raft carrying the food crashed likewise, and two of the men were flung to the deck. The raft veered to the left into a swirling backwater of floating debris and then had to be slowly warped round the edge of the wall with lines of rattan. It took two hours to clear this obstacle.

All next day they struggled along over rapids and round rocky islets. Then they came to a place where the river branched round a large island. The river was swollen by rain, and they were hurtled along at fifteen miles an hour, the heavy rafts bobbing up and down like corks as they were sucked into the whirlpools. Champion noticed that the right-hand fork was full of snags over which the water splashed in white spray. He tried to steer towards the other fork, but was carried by the current on to the point of the island. The next raft careered past and then suddenly buckled up as she struck a hidden snag. The third swept past like a floating leaf, missed the stranded raft by inches, and disappeared down the river. Fortunately, it was possible to salvage the rice bags on the stranded rafts, and two hours of pushing and hauling saw one of them released. The other raft had to be dismantled and taken through the

danger zone in sections. The remaining one was saved by one of the policemen, who swam out to it with a line, freed the raft from a snag, and then, swimming ashore, just managed to get a twist round a tree before the raft went sailing down river. Altogether it took two days to get started again. For half an hour they travelled along at a rapid pace, and then once again the expedition nearly came to disaster on a cataract. This time the native cook saved the situation by diving overboard with a line and just making fast before the raft reached the brink of the falls.

A few miles farther on the rafts stuck again, but this time some friendly bushmen gave a hand—and also gave the party some bananas, which were a welcome change from the dry rice they had been living on. A little lower down the current swept one raft under the overhanging branches of a tree, and the cook was literally plucked off by his belt. One of the policemen made a grab at the struggling man and pulled him off on to the end of the raft. The next day, however, saw the end of this sort of trouble, for they suddenly shot out on to the main Fly river. Down the river they made steady progress, meeting natives from time to time from whom they were able to buy sago. Nearer the mouth they encountered large numbers of natives who were evidently on the war-path. These evil-looking Girik swarmed round the rafts in their canoes, loudly demanding that tomahawks should be presented. One young man jumped aboard and began wandering round and looking the gear over. Champion did not wish to start a fight, but he gently took the man's arm and led him to the end of the raft, where, much to the explorer's surprise, he got back into the canoe without offering resistance.

A few days later they heard the dull rumble of distant drums. Once again they were meeting a tribe on the warpath. The drums would be loud, then faint, then die away for a time, only to commence again. Suddenly the drums seemed to be just ahead and, rounding a bend, they saw flaming torches being waved about for hundreds of yards along the bank. Swift canoes painted in red and white stripes came darting out of the shadows, and a moment later the rafts were surrounded by snapping natives holding out bundles of arrows and demanding

axes. Some tried to come aboard, but the armed police kept pushing them off, and when at last rifles were presented at them they sheered off. On July 11, after sailing for 500 miles on their rafts, they at last reached villages where there were police officers, and late the same night they caught sight of the riding-light of the *Elevala*. There was a call through the gloom, a flash of lights, and finally the welcome sound of Karius's voice. The long journey was over.

When Karius heard Champion's story he decided that another effort must be made while their memories were still fresh, and after a rest for two months at Port Moresby fresh stores and carriers were loaded on the *Elevala*, and off they went again. The journey up to the limestone barrier was not without the usual difficulties, but by the end of November Karius and Champion and their men had reached Bolivip again. Once again the friendly natives hugged and patted the "men from heaven," and made realistic signs to show how much they had been missed. At first, however, the natives seemed very reluctant to guide the expedition to the mysterious Takin river, until Champion promised the chief that if he would guide them he should be given a big steel adze. The chief's face beamed. This was beyond his wildest dreams. A steel adze! He would certainly take them to the Takin. The chief also was able to supply the names of several more tribes who lived down this river, and it became even more clear that the Takin was the Sepik.

In return for supplies of taro Karius gave the villagers some small knives and mirrors. The mirrors were a great success. The women who had been watching the ceremony from the end of the huts could scarcely constrain themselves when they saw their menfolk titivating their hair and faces with ornaments. In time the mirrors reached them, and with gurgles of delight they began to pat their hair and dab their extremely ugly faces.

When the time for departure came the men of Bolivip at first refused to go into the mountains, but as soon as Karius explained that the bags contained food (the Bolivip people had never seen rice before) the men sprang forward. As they approached the great perpendicular walls of the Dap Range the broad track abruptly changed into a narrow path, where it was

necessary to cut a way through tangled vines. At length the thickly wooded wall was reached. Up they clambered, clinging to roots, to the trunks of trees, and to narrow footholds. Sometimes the wall actually leaned over, but the guides went on hour after hour until at last the top of the bluff was gained. The aneroid showed 6500 feet, yet they were still only a mile to the north of Bolivip. The carriers staggered up in twos and threes, flung down their loads, and collapsed for a few minutes on the ground. One of the coastal carriers, who was a bit of a clown, made the comment in English, "By golly! Six pounds for that! No fear—it's worth a tenner!" These carriers had been engaged for six months at a pound per month.

It was cold on the heights, and the guides soon pushed on through heavy, moss-covered scrub and over limestone to a large cave on the banks of a stream. Here the night was spent, and the Bolivip men had their first meal of rice. Next day they followed the bed of the torrent into a steep ravine, and at one place ladders had to be made of lawyer cane to clamber over a wall. Here and there, as so often happens in Karst country, the stream disappeared underground. At 7500 feet the chief indicated that the path now went to the north-east, away from the stream, and that beyond this point there was no water.

He found it best thereafter to prod every patch of moss before stepping on it. The country was a nightmare jigsaw of coral limestone, and when the tent was pitched that night it stretched across several small potholes which they bridged with wood. Indeed, since there was no earth to hold the stakes it was difficult to pitch the tent at all.

Next morning, after a scratch meal, they pushed on over the maze until they came to a seemingly impassable wall covered in vicious-looking pinnacles. The guides went straight ahead and through the wall by a natural arch, four feet wide and adorned with small stalactites. A little farther on there was a tiny pool of water. Everybody drank deeply and passed on. Soon a col joining the Dap and Victor Emanuel Ranges was reached, and near by a camp was pitched by a tiny trickle coming out of the rock—it was the source of the Fly. While camp was being pitched it was noticed that one of the men was missing. Two policemen were sent to look for him. At length he was discovered sitting on the track nursing a wounded arm. Apparently he had fallen into a gaping hole but saved himself by clutching a projection part of the way down. There he had stayed until he felt strong enough to climb out, although he was too weak to travel any farther. The poor fellow was brought into camp and revived, but from that time onward he lost the use of his arm.

That night was bitterly cold, and the next morning when the divide was reached, at 9000 feet, it was still raining hard. Now began the descent to the Takin, but, although the going was downhill, the country was just as difficult and some of the carriers were wailing that they would die. One chasm was some twenty feet wide and spanned by a small tree a few inches in diameter. As the white men gingerly straddled their way over it they looked down into the jaws of a gigantic man-trap as it were, with a gaping maw zigzagging down into the bowels of the earth. Suddenly the rain stopped, and the party stepped out on to a small, sunlit plateau and gasped at the view before them. Several thousands of feet below was a great mountain-fringed basin and in the depths meandered a slow-flowing stream. On a projecting rock the Bolivip chief stood pointing to the valley and calling "Wok Takin. Wok Takin." It

was like Moses standing on Pisgah to point out the Promised Land.

In the distance rolled range after range of high mountains, but at their feet stretched a grassy plain and a clear way through a gorge to the Sepik valley beyond. Quickly they descended to the valley, Champion wounding his knee on a boulder as he scrambled down a steep slope. Then the chief went off to find his neighbours, the Feramin tribe. He soon returned with a trembling native and showed him how to shake hands with the white men. The man promised to fetch his friends and bring food.

Next day visitors arrived from all directions, and the Bolivip chief proudly showed off his guests. Finally he harangued the very impressed Feramin, and then, having received his pay of tomahawks (and the precious steel adze), he departed for his home across the range. At daybreak a guide took the explorers along the Takin valley as far as the boundaries of the Kelefomin people. He would go no farther, saying that he would be killed if he did. For some miles the way led through tangled scrub, and at last a great grass plain was reached. Soon they heard a peculiar frog-croaking noise, which seemed to get closer. It was the rallying call of the Kelefomin. Now the noise came from all directions, and armed men were seen running from a wooded ravine. Fortunately the white men were able to make friends and were allowed to pass unmolested through village after village.

Soon the country of the Kelefomin was passed, and at length, after winding through a woody ravine, a new tribe was encountered. Their village was soon humming like an upturned beehive. Men were racing about collecting their weapons, and as the carriers marched steadily ahead they came upon a line of fifteen men armed with bows and arrows and bravely preparing to resist. When they caught sight of the strange devils approaching, however, their courage vanished, and they fled into their houses. The explorers went about calling "Avino" (friend) and, by offering sticks of tobacco, at last made friends. Some baked taro was provided, and then on they went again, passing from tribe to tribe, until a great tributary flowing into the Sepik (Takin) was reached. By this time Champion's knee was be-

coming very painful, and one night he found that he could not get out of bed to fetch a drink. To be crippled at this stage was a serious mishap, for there were only eleven days' full rations left and they were still in the mountains. The next day four carriers stumbled along with the explorer suffering agonies on a stretcher, but it was imperative to push on since their rations would only hold out long enough to reach a place where it would be possible to start rafting. The country too was very difficult again, and one day's march was but two and a half miles.

Next day they had to cross the river by a native suspension bridge 120 feet long and 40 feet above the river. The problem was how to get Champion over since the stretcher would have to be carried by two men only and they would have to have their hands free to clutch the crazy handrail. Eventually the stretcher was suspended on the shoulders of two sturdy policemen, and after half an hour they had passed the swaying bridge. A little farther on a large garden of potatoes provided a welcome change of food for the men, but was no help to Champion, who had a dose of fever and could eat nothing.

On December 17, in order to round an impassable wall of rock, it was necessary to climb to a height of 4500 feet, and when they reached the river again at 950 feet they had travelled but a mile along its course. The next day brought them to another huge bluff, but this time a narrow native track seemed to go round the base just above the river. For 300 yards the men squeezed along past a rocky wall with the roaring waters of the Sepik washing their feet. At two places the track had been washed away and bridges had to be made, but soon they came to a break they could not pass and so had to return. This involved a climb of a thousand feet to the top of the bluff, and by noon they were just a stone's throw away from their starting place that morning. For eleven days Champion had been carried on his stretcher, but now he decided to try to walk, and, with the help of two sticks, he hobbled along slowly, but faster than he could be carried. Though the rations had been eked out, there were now only five days' rations left and the mouth of the Sepik was over 600 miles away!

Early next morning they had the good luck to strike a sago

patch, and spent the whole day making sago. This addition to their supplies put new heart in the men, and they pushed on until the next obstacle—a wide tributary—was reached. Although a large crocodile had been seen and the stream was full of snags, an armed sergeant swam across to the far bank and tried to bridge the stream by felling trees. When this attempt failed Karius ordered a suspension bridge to be made. As they had no string a piece of lawyer cane was used to act as a primary cable, this being tied to a stone and thrown across the river. Then a thick cane cable, 60 yards long, was dragged in from the scrub, hitched to the line, and hauled across. By noon a good bridge had been built and the whole party were safely over. That evening they passed out of the country of precipitous mountain-sides, small ravines, and deep gullies and looked out over a vast plain of flat forest country.

Next morning Karius, who was in the lead, suddenly came to a village. The natives, taken by surprise, drew themselves up in a line three deep, fitted arrows to their bowstrings, and drew. Karius slowly advanced, calling out all the peace words he knew and waving his arms in token of friendship. A moment tense with danger passed: the natives decided that the weird stranger was no enemy, and shouts of defiance changed to cries of welcome.

Soon after leaving this village one of the carriers collapsed and had to be carried. The way led through a vast sago swamp where the going was terribly difficult, and, in order to pitch tents, platforms three feet above the swamp had to be rigged up. Next day the river was located again, and an attempt was made to begin rafting. Eight days were spent in making sago and building rafts, eighteen feet long, out of big logs. But the wood proved to be unsuitable and soon lost its buoyancy. It was decided that Champion should make an experimental trip. The river was very swollen by the recent rains, and Champion and the crew soon found that they could not control their clumsy craft. Before long the raft crashed on to a snag, and Champion found himself pinned ten feet under water between the raft and the snag. He struggled free, and was dragged ashore by the crew, who had jumped clear when the raft struck. After this experience it was decided to push on through the

maze of swamps and jungle for a few more days before trying again.

The fallen trees swarmed with myriads of insects—ants, lizards, and scorpions, and in places the swamp was waist deep. There was plenty of food, of course, since this was sago country, but the river water was undrinkable, and soon half the party were ill with diarrhœa and fever. They longed to get out of the swamp with its croaking frogs, clouds of biting insects, and stink of rotting vegetation, and after hours of torture reached a level space by the river where they could rest. To their joy they found some trees suitable for rafts, and five days later launched their home-made craft. It was January 17, 1928, and they were still 580 miles from the mouth of the river.

Now and again the rafts were nearly capsized on snags, but soon they were speeding along a wide river comparatively smoothly, being given food at a native village *en route*. Early next morning they were suddenly startled by a rifle-shot. The rafts drifted round a bend, and then came a deathly silence. For there, more than 500 miles up the Sepik, lay the *Elevala*, which had come thus far to rescue them. New Guinea had been crossed! Karius and Champion had achieved the impossible.

In 1938 the Gill Memorial Medal of the Royal Geographical Society was awarded to Ivan Champion as a recognition of his valuable explorations in New Guinea, including the journey he made up the Bamu river and across the mountains to the Purari river in 1936. As a result of this journey several tributaries of the Purari were discovered, unknown mountains and lakes were described, and a new Government Station founded on Lake Kutubu.

2

EXPLORING NEW GUINEA BY AIR

IT WAS not until 1936 that Bolivip was next visited by Europeans. In that year an expedition was organized to prospect for gold in the mountain ranges between the Fly and Sepik frivers. It was arranged that there should be a ground party which should advance in the usual manner, and that they should be supported and provisioned by aeroplane. An Australian airman, Stuart Campbell, was the pilot of the Sikorsky Amphibian, while the land party was led by J. Burke—the whole expedition being under the command of an American, J. Ward Williams. Aerial reconnaissances were made over the area during 1935, the course of the Fly was plotted, and several flights in search of possible aerodromes were made over the dividing range into the valley of the Sepik. Here they found several huge, grassy areas which looked promising, although they dare not risk a landing until the ground party had made sure that there were no swamps or rocky hillocks.

An advanced base was set up on the banks of the Fly not very far from the mountains, all supplies and carriers being flown thither across the difficult, forested country of the lowlands. On September 19 the walking party set off for Bolivip, where it was arranged signs should be shown if they required any further supplies or food. The aeroplane was to fly every day along the trail and in this way it was hoped to maintain contact. The thick jungle, however, prevented the pilot from even seeing the party, until on the ninth day he saw them in the village square of Bolivip. They were displaying signs that all was well but that more rice was required. Four thirty-pound bags of rice were dropped, but three of them landed in an impossible position in a ravine and so the plane flew back to the base for more bags. An hour and a half later they were flying over the outlying mountains again, but by this time the valleys were filling rapidly with clouds, and to reach Bolivip it would have been necessary to fly low beneath the clouds. Therefore

the plane had to go back, and it was not until a week later that they were able to reach the native village again. By this time, however, the land party had grown tired of waiting and, buying up all the taro they could, they had pushed on over the mountains. They climbed more or less on the route followed by Karius and Champion, and, like their predecessors, they found that the native carriers suffered acutely from the cold and the rarefied air of the 10,000-feet highlands. Only fifteen of the thirty-three porters reached the camp that night, the others sleeping out in the wet bush. The next day the highest point was reached at 11,000-feet and they camped that night where Karius had camped ten years before. In the morning, sick, torn, and weary from the struggle across the limestone, they straggled down into the huge, grassy valley of the Sepik. They had crossed the mountains and the goal was in sight, but the position was by no means cheerful. Only two days' food-supply remained, and nothing had been seen of the aeroplane for six days. If the plane had been damaged then the outlook was very serious.

Meanwhile the aeroplane had been searching along the course of the Fly river without success, and on the third day after the second flight to Bolivip the pilot flew his machine through a small opening over the top of the mountains into the sunny valley of the Sepik. Here the crew searched for half an hour and had almost given up hope when they saw a dense cloud of smoke high up on the northern slopes. Flying on they saw the tents pitched on a small grassy ledge, and, as they had expected, the signal for more food was displayed. They dropped a big sack of rice, and then flew back to the base bearing the good tidings that the ground party had been sighted.

About a week later the ground party had established themselves on a grassy plateau. A landing-ground was cleared, and Stuart Campbell made the first landing at the head of the Sepik. Immediately afterwards petrol and other stores were flown over from the Fly river, and the new aerodrome in the wilderness became the base for all the explorations of the next five months.

During this period the members of the expedition had ample opportunities to study the unspoiled native culture of the

mountain tribes. Walled away from the rest of New Guinea by wild and rugged mountains, and surrounded by traditional enemies, the natives seldom travel far from their own valleys. Every tribe is at enmity with its neighbours, and foes slain in battle are usually eaten. Yet in some respects these are a happy people, living a simple, idyllic life in the bracing mountain air.

There is no clothing as such, but all manner of personal ornaments are worn—from the elaborate coiffure, with its bone pins and bunches of feathers, to the gourd worn between the legs. The forehead is often adorned with a string of small parrot feathers or dog's teeth or small cowrie shells. The beard, which is worn by all men, is sometimes decorated with brightly coloured beetles or the dried skins of small birds. A pig's tusk or a short piece of bamboo is thrust through the septum of the nose, and in the nostrils are inserted the horns of a rhinoceros beetle. Both men and women wear necklaces of pig's tusks or cassowary quills, and armbands of twisted rattan are common. Around the waist are loosely wound the strands of thin rattan, which are used in making a fire by the primitive method of twirling a wedge in a cleft stick. Both men and women wear a string bag round the neck, in which they carry tobacco, small grasshoppers, lizards, and quantities of other queer treasures. Sometimes these hold-alls are decorated with gaudy bird plumes.

For weapons the tribesmen rely upon bows and arrows or flat clubs of palm-wood. The arrow barbs, which are not poisoned, are made of bamboo or bone. Large painted shields of light wood are also carried.

A typical village consists of a cluster of about a dozen roughly thatched houses arranged in a square, and in addition three other buildings of special importance. In the sacred 'men's house,' where the trophies of hunting and war are treasured, the jaws of wild pigs and crocodile skulls are specially honoured. Sometimes the gruesome exhibits hung about the walls include smoked human heads. Another special building is the dance-house, where, to the accompaniment of drums and a monotonous song, the natives perform their rhythmic dances. The third communal house, which is entered by a ladder, is built on piles about 30 feet above the ground. This room seems to act partly as a castle-keep and partly as a men's club.

Religion, apparently, is a matter of sympathetic magic and superstition—the pig being the chief object of reverence. The common practice of painting the face, arms, and thighs with red stripes has also some obscure religious significance. What trading there is is by barter—though for the most part the tribesmen rely upon their gardens to make themselves self-supporting. As frequently happens among primitive peoples the land would appear to be held on a communistic system.

The explorers surveyed all the near-by tributaries of the Sepik, but they found no gold. The plane then began to fly farther afield, and soon a great new valley was sighted behind the Mittages Mountains, and a land party went off to explore this new region. Once again the search for gold proved fruitless, and so they turned their attention to the main Sepik valley.

A new tributary of the main river was discovered, and it was decided to land a party there to explore the large mountain area to the north, which had never before been visited. In view of the dangers of this new country it was decided to fly down to the coast and bring a second plane. The natives in the mountains were hostile, and once across the divide the explorers found rough, trackless country, in which there was not even enough flat ground to pitch the tents. Frequently wooden platforms had to be constructed on the steep, razor-backed ridges before a camp could be made. It was difficult to keep in touch with the planes, and several times they were down to their last meal before a satisfactory spot could be located where new supplies could be dropped. Eventually they reached a stream which seemed good enough for the use of rafts, but as so often happens in New Guinea the stream proved to be too fast, thus the rafts were smashed on the rocks, and much valuable gear lost. At length the flat land along the May river was reached, and a large area was prospected unsuccessfully for gold. Altogether several thousands of square miles had been investigated, and several alterations and additions made to the maps of Central New Guinea, but nowhere did they find the rumoured El Dorado of the Papuan gold-miners.

3

ADVENTURES IN UNKNOWN PAPUA

ONE MISTY morning in May 1935 a canoe came drifting to the wharf of the Ogomobu plantation on the Kikori river. Two wet and dirty officers, barefooted and with bushy beards, climbed out of the native craft on to the steps, where they were greeted by the plantation manager.

" Which is Hides and which is O'Malley? " he asked. The two officers could barely answer, so great was their excitement in meeting one of their own kind again after so many months of danger, hunger, and slogging travel along what was officially proclaimed " the most difficult and the most dangerous patrol ever carried out in the whole island of New Guinea."

They had set out in January 1935 from the mouth of the Fly river to explore the huge region—roughly the size of Wales —lying between the Strickland and the Kikori rivers, which at that time was completely unknown land. A government launch took the party of two whites, ten native policemen, and twenty-eight carriers (including one or two released convicts) up the great artery of Papua and then along its tributary, the Strickland, as far as an island beyond which there were rapids and dangerous currents. From this point a native guide led them towards the upper reaches of the river in their four canoes loaded with rice and other food and equipment. Gradually the low marshy country, with its mosquitoes and sago palms, was left behind. Rapids became more common, and on the eighteenth day a range of strange mountains could be seen about thirty miles away. On that day the long-sought tributary giving access to the unknown was found and named the Rentoul. So far plenty of alligators and pythons had been seen, but there were no signs of natives.

Hides took a small party in advance up the new river, hoping to find some signs of human habitation. Sure enough, they suddenly came upon a bamboo raft tied to the bank. There were fresh footprints showing in the mud, so they followed these

until at last they came to a native village where the women were making sago. Three archers stood on guard. Hides and the native guide stepped forward, holding a length of red cloth as a peace offering, but the women bolted and the archers began firing at one of the policemen. The policeman had apparently stumbled into a swamp, and was forced to fire his rifle at the advancing archers. This was an unfortunate beginning, but Hides decided to push on up the Rentoul and try to make friends with the natives higher up. However, as they struggled upstream towards the mountains the nomads would not make contact and, indeed, roused the whole countryside by a curious warning cry which sounded like the croaking of a myriad of frogs. Meanwhile the terrific work of hauling the canoes over the ledges of rapids went on until they had travelled forty-one miles up the Rentoul. Here the canoes had to be abandoned, and four policemen, two disabled carriers, and the native guide set off downstream with the last messages for the coast, now 500 miles away.

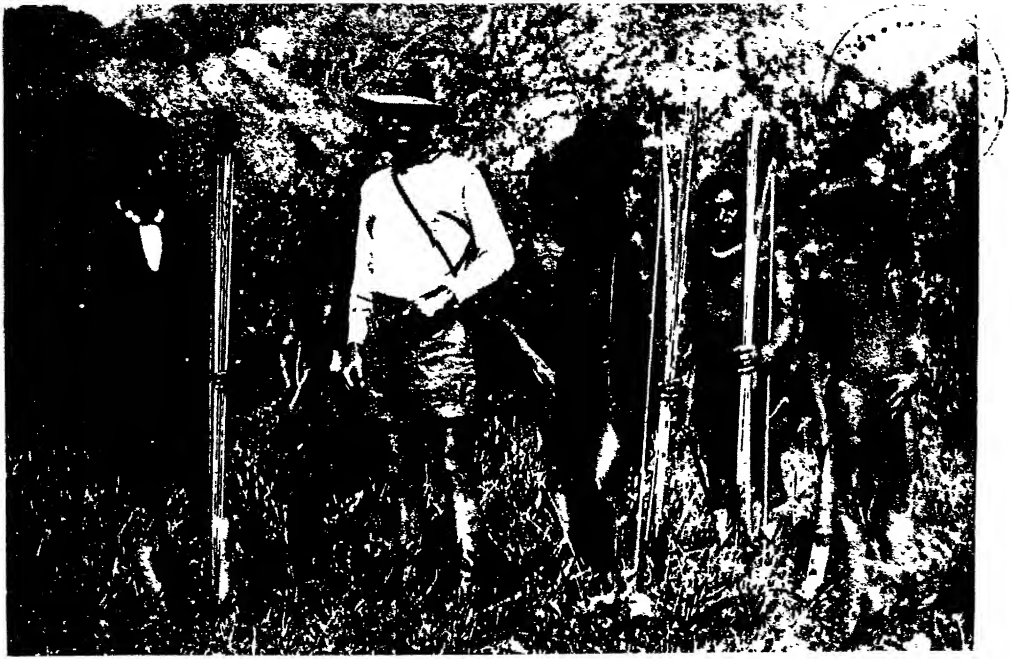
The next few stages led through forest, and two constables went ahead cutting a track for the laden porters. The natives seemed to be avoiding the intruders, although from the hillsides columns of smoke could be seen rising from various points. The way led across the spurs of the O'Malley Peaks, rising to 11,000 feet. There were many deep valleys with precipitous sides and in the background the 12,000-feet limestone barrier—that terrible spine of Papua which had proved such an obstacle to Karius and others. Although Hides was prepared to tackle this range if necessary, he continued to push on north-eastward across the plateau he was then on, hoping to find native populations. At last the plateau ended in the Humphries Range of mountains, and so it was decided to make for the barrier and take a chance on what lay beyond. By this time the tents had been attacked by some fungus and were rotting so rapidly that it was difficult to keep the rice dry. Before long contact with the natives would have to be made or else the problem of mere survival would become acute.

On March 20, when the limestone barrier was so close that it seemed to tower over the camp, the explorers at length came into an inhabited area. Towards evening smoke was noticed

rising from three villages, but so far the natives had given no sign that they were aware of the encampment. Then through the dusk long lines of torch-bearers were seen, and from across the valley came a sound like the baying of hounds which swelled into harmonious war songs. Next morning a crowd of native archers appeared on the grassy ridge before the camp, and, although Hides made friendly gestures, they began to shake their bows and hoot at him. The band was harangued by a priest mounted on the shoulders of another native, but in the midst of the proceedings O'Malley whistled shrilly. The effect of this weird noise from the god-like invader was both instantaneous and ludicrous. The priest was dumped in the most undignified manner, and the whole band fled into the bush.

But the expedition was not able to avert all opposition by these methods, and the next day a volley had to be fired before the natives at the next village would let them proceed. Due care was taken that nobody would be hurt by the volley, but once again all the natives fled and once again it was impossible to get fresh food supplies. The party moved on, bridged a river, and were just preparing a camp-site when the natives attacked. Hides was ambushed by two bowmen—an arrow whizzed past him, and then one of the police shot his assailant. The rear of the column was also attacked, but Sergeant Orai scared the natives off by firing over their heads.

April came and they were still toiling through the difficult, broken country at the foot of the range. At each village efforts were made to win over the natives, but always the presents were rejected and the villages deserted. At last the end of the inhabited region was reached, and a great area of unknown mountains still separated them from the Purari and their chosen homeward route. The only hope of success now lay in breaking through the limestone, and they hoped to find people there. Like previous explorers, however, Hides and O'Malley soon found that the Barrier is a frightful stretch of country—"a desolate, silent land, where only bandicoots and pythons can find a home. The rock is honeycombed and stands on end; it forms fissures and craters, large and small, and every step has to be watched, for the limestone edges are as sharp as broken glass." It was impossible to cut a straight course as they



SOME MEN OF THE PAPUAN INTERIOR WITH HIDES

From "Papuan Wonderland," by J. G. Hides (by permission of Messrs Blackie and Son, Ltd.)

A Native of Papua

From "Papuan Wonderland," by J. G. Hides (by permission of Messrs Blackie and Son, Ltd.)

wound along narrow corridors of rock or cut their way past huge caves, where they could hear the rumble of underground rivers. The days dragged on into weeks as they struggled on across the limestone, relying for their water-supplies on the cold rain which fell on the rotting canvas of the tents. The outlook was far from cheerful. A perpetual blanket of fog covered the land, and several of the porters were suffering from deep gashes caused by the rocks. Another trouble was caused by the little fern leech, which were flung into their faces as they slashed at the drenched undergrowth. These pests sometimes crawled under the eyelids to suck the blood. There was one bright moment, however, when the porters discovered a big cave which was inhabited by hundreds of flying foxes. The half-starved men began throwing stones like madmen whilst others stood at the narrow entrance knocking the bats down as they tried to escape. That night every one gorged on bat's meat, and as they moved on next morning they all stank of flying foxes.

Before long the expedition was down to its last few bags of rice, and several of the men were suffering from scurvy. But the only hope still lay in the north, and they pushed on until at last the rocky chasms and craters grew less, and from the top of a tree Hides glimpsed a great valley ahead with evidences of population. Passing down from the range, they went through a region where there were huge landslides, and eventually reached a mighty mountain torrent, which they guessed to be the Kikori. Soon other tributaries were met, and from the top of Landslide Mountain the weary toilers saw beyond a gorge a huge valley system with cultivated clearings on every slope and many little columns of smoke.

" My mother," said Sergeant Orai, " people like the sand. They have plantations. What people are they? "

" What if they are bad-tempered? " asked one of the porters.

" Well, what? " said the brave policeman. " We are ten! "

Before long they encountered a number of natives, who seemed frightened to approach. The officers showed them axes, and tried to make them understand that they wanted food. The natives pulled up potato vines, smacked their abdomens, and indicated that they could take all the food they wanted, but they still would not approach. Next morning, however, when

everybody had had a good feed, about thirty of the natives were induced to come into the camp. Hides was astounded to find that the men were clean and light-skinned, and had mops of brown hair adorned with flowers. They all had bone daggers stuck in cane girdles round their waists. Then the chief, who was a big, bearded fellow with a cassowary quill through his nose, came forward and made a long speech. Illustrating his remarks with the jawbone of a pig, he made it clear that ahead there were thousands of people, but that they did not want the steel the strangers had offered as presents. Apparently the local currency was in cowrie shell, and the chief was disappointed when the explorers had none to offer. Hides produced a mirror, but when the chief saw his own face he jumped back and ordered the glass to be returned to the white men.

By this time the natives had apparently come to the conclusion that the white men were not to be feared, and as the party moved off next morning the police noticed that an ambush had been prepared along the banks of a creek. Hides fired a shot over the ambushed men, who promptly fled, and the police pelted the arrogant chief with pebbles.

At the next village a timely present of some sugar produced the information that the Waga Furari (Purari) lay to the eastward, and for the next few days the natives in the great valley were friendly and good progress was made. At length a great mountain, named Mount Jubilee, was sighted, and it was clear that the Kikori rose somewhere on its flanks. Now they began to pass out of the great valley they had entered and reached a land where the natives were not so friendly. Before long yodelling started on both sides, and a large crowd of natives was observed to be closing in on the expedition. A few shots were fired over their heads, and the yodelling at once ceased whilst the men stood in amazement. After this the natives seemed to think it diplomatic to feign friendship, but they would provide only the most miserable food supplies. Moreover, they tried to ambush the explorers as they moved along a creek next day, but O'Malley succeeded in beating off the attack. Fortunately, a native guide made friends and led them to his village, where good food was obtained, and thence he took them towards a large mountain (Mount Champion) where the Purari rises.

The health of the party was still not good. Several of the porters had abscesses, and both the officers were suffering from painful sores. However, for some distance, as they marched eastward through farmed areas, there were plenty of guides. The route led towards a high pass between Mount Champion and the neighbouring peak, and from this vantage point they could see an enormous stretch of country. The weather was bad, and the cold rains of the highland made the porters suffer agonies. One of the porters fell exhausted, and had to be carried in by brave but half-frozen volunteers. The poor fellow was brought into camp, but the cold had been too much for him, and he died five minutes afterwards. All next day the stricken explorers struggled on, until at last the track dropped to 8300 feet and a large valley system could be seen with an even greater population than the Tarifuroro valley, which they had just left. It was the fifth of May. Only a few pounds of rice remained, but Hides felt certain now that the Purari would soon be found and that the homeward route would be safely accomplished.

Yet there were many dangers still to be faced. They had now reached a land of fierce, dark-skinned men, who soon began to yodel their warning cries and to gather around the little party of invaders. Soon a thousand armed natives had encircled them, but they did not attack. Friendly relations were established, and soon the natives were swarming over the camp inspecting and prying into everything. Five days later, however, an unfriendly tribe was encountered. A strong guard was posted round the camp, but the hooting and yodelling still went on. No food was offered, and by this time the whole party were starving men. So far no shots had been fired in this country, and the treacherous natives seemed to think that the rifles were just wooden clubs. A bridge was safely crossed, but the tribe on the other side were also hostile and would offer no more than a few measly potatoes in exchange for trade goods. It was becoming clear that the natives thought the party so weak that before long they could be attacked and plundered with impunity.

Hides ordered all the police to load their carbines, and, with the carriers bunched together, they went off into the bush.

Suddenly there was a terrific din of yodelling, and the whole line was attacked. Hides fired to the front and at men in his rear, who came rushing up with short, stabbing spears. Constable Badua was so beset by spearmen that he began using his rifle as a club. Then he was pulled down, and a native with a battle-axe leaped on top of him, but Hides saw his peril and shot the attacker. The battle only lasted a few seconds, for the thunder of the rifles had the usual magical effect. Indeed, the natives now decided to become friendly, brought presents of food, and provided guides. For the next few days all went well, and the natives along the route began to bring in sick people to be cured by the magicians—including even a man with a broken spine!

The grass country still extended for miles before them as they wound along the valley of the Wen river beneath a mountain precipice of rock. Once again the dreaded yodelling was heard, and before long the column was attacked by a large crowd of big black men with large pom-poms of cassowary feathers on the tops of their heads and bearing shields painted with human designs. Two of the charging horde were shot, and the rest fell back uttering cries of warning. At this stage things seemed to be so bad that Hides began to think the journey would never be finished. One of the porters had become so weak that he had to be carried, and as they pushed on through the hostile region the food position was once again precarious.

That night the camp was made on a little open space which could be approached by three roads. The yodelling had started again, and it was clear that the preliminary skirmish had not ended hostilities. The Sergeant and three policemen went off to fetch water, and came back with the news that a massed attack was being prepared on all sides. The carriers were bundled into a deserted house, and the police were detailed to guard the three roads. As a last resource the house should be the final rallying point.

The first charge came along the northern track, and Hides was narrowly missed by the first arrow to be fired. No sooner had the guard repelled this attempt than the other parties charged, and the whole party were firing for dear life. Six rushes followed one another in rapid succession, but so steady

were the police that only two of the attackers broke into the open space, and then only to be instantly shot. At nightfall lanterns were placed in the tracks, and a watch was kept. But the natives had apparently had enough, and did not attack again. So far none of the patrol had been killed, although the weak porter died during the following night. Worse misfortune was to come, since a few hours later Hides had an acute attack of dysentery, and as they went ahead the next day through tribes which were still hostile he suffered increasing pain. The whole day long armed men hovered on the flanks of the trail, and it seemed that another attack was imminent.

A little farther on an impudent native offered himself as a guide and straightway tried to lead the party into an ambush. Hides managed to keep the peace, but the natives then demanded that the carriers should break the souvenir bows they were holding. When camp was pitched the natives pestered the men, and to show their contempt for the weakened column would suddenly pretend to be very frightened and run away only to return a few moments later to push the poor carriers about. Evening came, and once again a sudden attack had to be repulsed by rifle-fire and the howling and yodelling went on till daylight the following morning.

Hides was now in an extremely weakened state, but the advance was continued, although now they were seeking a way out of the densely populated and hostile area. Once again limestone began to be prominent as they approached the great barrier. Here cultivation was found in scattered basins. In one village an attack had to be beaten off, and in another an ambush was narrowly averted; but at last they seemed to be reaching an uninhabited area, and felt safe for a while. Climbing out of one basin, an altitude of 7500 feet was reached, and from this point the guides pointed out a great slow-moving stream, the Elai, which entered a deep gorge in the limestone barrier. Hides guessed that this stream must be a tributary of the Purari, and decided to trust to luck and go down the gorge.

At the very mouth of the gorge a tribe of hostile natives attacked the party, and prepared to ambush them on the far side of the river. One of the men was captured and taken into the gorge as a guide. The track became fainter, until at last it

faded out, and Hides decided to raft. It was a big risk, because the river flowed here at a level of 4500 feet, and somewhere in the 'broken-bottle' country before them there must be a great waterfall. Some large cork-trees were found, and a camp set up whilst the rafts were built. Hides was still terribly ill, and the rest of the party were in poor condition owing to the scanty food supplies of stringy potatoes, mushrooms, and goru palm leaves. Hides hoped that they would be able to raft for a few miles to the south and so save several days of torture among the craters and pinnacles of the nightmare barrier, where the spent carriers must surely have died.

In the end four rafts were built, and, the prisoner having been released, they set off. On either side gigantic walls of honeycombed limestone towered to the heavens, and every bend was a nightmare because, as the river went on for two, three, five miles at about the same level, it became clear that soon they must reach a drop of about 2000 feet to the known level of the Purari. There were razor-backed islands of gaunt limestone to be avoided also, but all went well for a glorious six miles when suddenly shots were heard from the leading raft, and then the roar of the tumbling water. Everybody jumped up and paddled away to draw the rafts into the shore. One raft became unmanageable, and the crew swam ashore, leaving their craft to be carried on and smashed to pieces over a thundering waterfall. It had been a narrow escape, but at least six miles of the barrier had been overcome.

Clambering along the edge of the river, Hides decided that somehow they must reach the heights above and so spy out the nearest inhabited area. He was in a terrible predicament, for he had no food for his men and all he could offer was the assurance that somewhere beyond this tortured landscape lay the Purari and plenty of supplies. Gradually ascending all the time, the way along the gorge was finally blocked by huge limestone cliffs, so a steep path had to be cut right to the summit. They had barely reached the top when one of the policemen came upon a native. He was a fairly old man and not very friendly, but he meant life to the expedition since he could lead them to food and people. One of the porters patted the prisoner with affection, touched Hides's stomach, and, pointing east-

ward, began to chew. The prisoner, instead of understanding what was intended, was horror-stricken and apparently thought that at some place farther east he was to provide the supper for the white man. Eventually he was made to understand, and he led the way round the craters to a track leading eastward. The following afternoon a small cultivated area was reached, and for once in a while everybody had a good meal. Soon they were in another great grassland, which seemed to occupy a split in the barrier and which indicated that the remaining stretch of limestone country to be crossed could not be very wide.

Marching through a grove of bananas, the column was suddenly surrounded by two hundred of the fiercest savages Hides had yet seen. They were big black Papuans, with large head-dresses of cassowary feathers, and nearly every man carried an article of steel. Here at last was country which had been in touch with Europeans—probably the Leahy brothers. Moreover, the men seemed to be quite friendly, and told the explorers that beyond the dwindling limestone to the south was a large river where men paddled along in canoes. It could only be the great Purari.

One of the constables now was terribly ill with dysentery, but Hides himself was getting better. With reasonably good supplies of food, however, they made their way more cheerfully towards the barrier, and were soon once again slowly skirting the limestone craters. Once again they suffered as they had done on the first crossing, but at last—barefooted, ragged, and starving—they all descended to the large river flowing eastward. Here there were real Papuan gardens—with taro, sugar-cane, and the climbing vines of sweet potatoes—and the friendly people even killed a pig for the explorers.

Hides now had to decide which route to follow down to the coast, and in view of the weakened state of his men picked the Zambrigi route to the Kikori instead of following the Purari. He did this because along this route he knew there were inhabited regions where he could get food, although he well knew that at one point (the Iehi chasm) he might have to face a danger far worse than any yet encountered. The divide was easily crossed, and the Zambrigi was reached the next afternoon. Thence they travelled to Mount Murray, where they

found the deserted camp of a lone white trader. The empty meat and salmon tins were a queer foretaste of civilization.

Three natives guided the expedition to the source of the Iehi creek, and told them that if they followed the water for four days they would reach the lowlands and the sago country. The river flowed along calmly, gradually increasing in volume as tributaries joined it, until quite suddenly the river petered out, all its waters having seeped into the limestone where they probably continued in an underground culvert. The river course still showed clearly above ground, and Hides knew that in the rainy season, when the underground channels were choked with water, the river flowed above ground in a raging torrent. Moreover, the bed of the stream began to descend rapidly, and soon they could see the dreaded Iehi chasm ahead. This chasm, which is seven miles long, has towering cliffs of limestone on both sides, and is noted for the fact that in the rainy season the dry boulder-strewn bed may become, within the space of a minute, an avalanche of water—a veritable death-trap. As the party entered the chasm it began to rain, but Hides could not afford to delay. The porters were carrying two of the men, and there was no food left. They tried to make haste, but the weak members kept the pace very slow. Hides sent on two of the stronger police to find a village and bring food and people to the rescue.

By the afternoon the chasm had narrowed to about twenty yards, and the going was very difficult owing to the many slippery boulders and the numerous cascades. There was no bird or animal life and, as the cliffs on either hand seemed to climb ever higher, no sunlight. In many places there were great piles of drift timber to give clear evidence of the cataclysmic floods which sweep the pass. And once the expedition passed two grinning skulls.

A little later they came to a deep drop, and a sixty-foot ladder had to be improvised out of timber and vine rope. This took some time, and darkness had begun to fall as the last of the weary men reached the ledge below. The rain still continued, and Hides now realized that a flood was certain. It was indeed a desperate situation, and the only safe spot for a camp seemed to be a little elevated terrace on a bend in the chasm.

Some of the carriers climbed into niches in the limestone wall and slept there, whilst others built rough shelters under an overhanging rock.

As luck would have it a terrific storm now burst upon them, and the rain fell in torrents. The officers sat miserably on their uncomfortable eyrie waiting for the inevitable flood. Now and again one of them would peer over the edge, where the white boulders in the bed of the stream still showed clearly as the lightning flashed.

About midnight they heard another sound above the rumbling thunder and the falling rain—an ominous roaring which grew ever louder. Sergeant Orai went quickly to the edge of the ledge and looked down.

"It comes, Taubada," he yelled. "The water-flood!" Then came the avalanche of water, which roared like an express train along the bed of the chasm and, in an alarmingly short space of time, rose to the terrace. In the darkness the whole party with their few miserable belongings were crowded on to the highest point of the ledge, and mingled with the turmoil of the elements came the terror-stricken cries of the wretched porters as they tried in vain to scale those vertical walls into safety. Fortunately the bend in the chasm protected them from being dragged away by the swirling waters, but the level continued to rise—slowly but inexorably as in the water dungeons of a Chinese torturer.

"It is above my knees," said O'Malley quietly. Like his leader he thought that the end had come. The water still rose. It reached their thighs; it came over their belts and then as if by a miracle it reached its greatest level and began to recede. For some minutes they waited tensely, hardly able to believe that they had escaped so narrowly—but there could be no doubt about it. Bare patches of rock which had been covered a moment ago were now clear again. Dawn came. The rain had stopped, and the chasm was dry and silent once more. All the men drifted in, and the sun shone as they went down and out of this remarkable natural death-trap.

By midday they were clear of the gorge, and the Iehi was once again a sane river, flowing in the usual way on the top of the ground. Here they met the two policemen, who were returning

with supplies of coco-nuts and cassowary. The limestone country had been left behind for good now, and there was plenty of food in the forested lowlands ahead. For four days they rested in a camp, where they made sago, killed pig and wildfowl, and generally feasted until every man felt stronger.

The next few stages were neither dangerous nor exhausting, although it rained incessantly as they travelled on through the forest. In spite of the fact that one of the men seemed about to die everybody felt in good spirits and the journey to the banks of the Kikori was soon accomplished. Here they met semi-civilization, and were soon provided with canoes which carried them rapidly downstream as far as the Ogomobu plantation. The long patrol was over. Emesi, the sick native (who had been with Karius and Champion in their famous expedition), died a day after in hospital. It was a sad ending to what had been a truly heroic expedition. Perhaps Emesi's own dying words provide the best epitaph. . . . " My lamp is going out. But no matter. I have Judge Murray's clothes on." In the struggle to civilize New Guinea the native policemen are proud to play their noble part.

4

HENRI LHOTE ON FOOT IN THE SAHARA

ALTHOUGH IT is true that the main geographical features of the Sahara are fairly well known, it cannot be assumed that its final secrets have been revealed, or that a journey across the desert is without dangers. The career of Henri Lhote well illustrates this. On his first expedition he spent four years (1929–32) in the heart of the Sahara and he returned thither in 1933 and in 1934–35. Although he is only a young man, he has to his credit an amazing journey on foot across the Tanezruft, a journey never before even attempted by a white man and rarely accomplished by natives.

The Tanezruft is the most desert region in the whole of the Sahara. The rare, wandering Touaregs, who are the only inhabitants of this area, are, moreover, among the most interesting of primitive tribes. Not so many years ago they were the most dreaded people of North Africa, and for centuries these mysterious veiled marauders terrorized the oases and raided every caravan which approached within reach of their secret encampments. Their strange dress—their famous black veils, or *lithams*, covering forehead, nose, and mouth—their barbaric weapons, have done much to add to their 'romantic' reputation; yet, in truth, they are few in number, and because of the wild, mountainous, infertile land they inhabit, they are doomed to live the life of hungry nomads in their goatskin tents. The veil is worn by every man from the age of adolescence. It is never removed even in the privacy of the tent. The Touareg eats and drinks under the veil, he sleeps, wearing the veil, on a bed of sand covered with a goatskin. The sheikh—so beloved of the romantic novelist—never washes, because water is too precious, and when he feasts on camel- or goat-flesh he eats every portion of the animal, even the skin being shredded and boiled for food. The Touareg is shockingly immoral, too. Probably that is why the matriarchal system of inheritance still persists.

Insolent, pig-headed, and treacherous, the Touareg's main interests in life are his camels and his weapons. Their racing camels, or mehari, are famous for their endurance, beauty, and speed. They provide milk, an occasional dish of meat, hair for weaving the burnous, and skins for making bags and saddles. The raider—mounted on such a steed, and bearing a long, slender lance with three barbs, a double-edged sword, a bracelet dagger attached by a band to the left wrist, and a camel-hide shield decorated with hieroglyphics—is indeed a warrior to be feared. Yet, as Lhote found, the Touareg has one redeeming virtue. The rigours of the desert life have made one law universal—that of hospitality to the starving, exhausted traveller.

In July 1931 Lhote set off from Gao on the Niger for Tamanraset in the Ahaggar Mountains. His route lay across the Tanezruft via the wells at Tin Zaouaten and Tin Raroh. It was arranged that he should go to the camp of a friendly chief, where he could engage a guide who would take him as far as the first well across the desert. The chief did indeed provide him with a guide, camels, a camel-driver, and two mounted tribesmen. The latter, however, planned to desert and join a caravan before the Tanezruft was reached. But, fortunately for Lhote, knowing the Touareg language, he soon discovered this plot.

Soon after they had left the camp the guide, who was the only one who knew the way, complained of a swelling in his left eye. Lhote noticed that the eye was inflamed, but thought the guide had been stung by a scorpion or a hornet, and was not unduly anxious. However, during the course of the day the swelling extended down the whole of the left side of his face, and he could no longer see out of one eye. On the next day the situation became worse. The inflammation had increased, and now the poor guide had both his eyes shut up. Perched on a camel, he forced his eyes open with his fingers and tried to pick out landmarks while Lhote verified them. " Can you see two small black rocks to the right of a little dune? " he would ask. So they progressed through a blazing inferno of July heat, guided by a blind man who trusted to his memory. They were forced to rest by night—the best time for travelling—because only by day was there no risk of missing the landmarks.

Early in the morning Lhote went a little way out of camp to do some surveying, and on his return was amazed to find the guide dead and his three companions busy digging out a grave. The sense of catastrophe was heightened by the utter loneliness of the place. The devout Arabs were alternately praying and weeping and wringing their hands. It was indeed an awkward situation since nobody knew the way. The two mounted tribesmen were restive, and said that since they were not paid by Lhote they would go no farther.

" I am aged," said one. " I cannot go farther."

" My camel is worn out," said the other, " and if I go on into the Tanezruft he will certainly die."

Lhote was in a quandary. He was about half-way from his destination and had to decide whether to go on or whether to return. Finally he decided to take the risk, and ordered the camel-driver to saddle the beasts. One of the tribesmen blessed the camel-driver and wished them a good journey. Then Lhote set off, with a compass and a map in his hand, to lead the little caravan into the empty wilderness.

During the night a depressing sandstorm had begun, and this had increased the evaporation of the water-skins. Moreover, instead of reaching an expected wadi Lhote found himself wandering ever deeper into the sandy desert with its tantalizing mirages. The sandstorm increased in violence until they could only make progress by doubling themselves into an almost crawling position. Then black clouds filled the sky, and they thought a thunderstorm was about to break. But it was nothing more than a return of the sandstorm, which lifted the sand high into the air and blinded them.

A little later they caught sight of a rocky hillock, and as by this time they could not make out the camels at ten paces' distance they decided to take refuge until the storm had blown itself out. No sooner had they unloaded the beasts than the two men wrapped themselves up in their burnous and sought shelter among the baggage. About midnight the storm died down, and for the first time since the previous evening they were able to prepare a simple meal of wheat-cakes and tea.

They were wakened next morning by the howling of the sandstorm which had begun again. But the camels had com-

pletely disappeared! The two men separated and went off to find them.

The sandstorm had effectively wiped out all the tracks so it was not until midday that Lhote returned to camp with his own racing camel. He had seen no sign of the remainder, and as their water supplies were already low the avoidance of further delay had now become a matter of life or death. The camel-driver said that, in his opinion, the camels had made for a little elevation about eight miles back, where they had seen a few ragged clumps of vegetation. He announced his intention of going to look for them there, and Lhote allowed him to take the racing camel. The driver was so certain that he would be back in a few hours that he took no water or provisions, and did not even bother to saddle the camel. Incidentally, Lhote thought that this arrangement would ensure that he himself should not be abandoned to his fate.

Nevertheless, he had a presentiment that the guide would desert, and as he sat down amid the baggage he wondered bitterly whether this meant the end of his three years' work. Would his cases be lost for ever in the immensity of the Tanezruft, where no one ever passed? And would his own carcase, pecked by a vulture, be left to whiten in the sun like the one he had himself seen when he was crossing the Air district?

This gloomy mood was happily dispelled by the antics of Boubou, a little monkey which had been given to him by a young woman on the Niger. Boubou had sensed the danger, and now followed his master around, watching his every movement.

No! thought Lhote. I must get out of this—or at least make an effort to get out.

Lhote forthwith prepared some victuals, including cooked rice, dried dates, and two quarts of strong coffee, and then made a careful calculation of the sheer necessities that he must take: the compass, the binoculars, the automatic, the map, and his notebook. He also decided to take a long rope in case he found a deep well. His shoes were badly worn, so, foreseeing a long march, he improvised a pair of sandals out of an antelope skin, and packed some long strips of leather so that he could repair them on the way.

Then, since the camel-driver had not come back, Lhote packed his cargo in his haversack and shouldered a skin holding two gallons of water. He estimated that thus provided he could hold out for possibly five days, but it was a heavy load. Finally, having set out some food and water just in case the camel-driver returned, Lhote started off.

His spirits revived now that he was no longer wasting time at the camp. The sun had set, and he was soon making rapid progress across the desert, using a long antelope horn for a walking-stick. Boubou came bounding along behind him, and seemed to be enjoying himself at first. Then the monkey began to tire, and ended by weeping like a child. His master helped him along for a mile or so, but finally Boubou grasped him firmly round the leg to show that he had reached the end of his tether. Lhote, therefore, perched him on top of his haversack, and the little fellow clung to his neck.

They went on like this until eleven o'clock, and then took a rest in the shelter of a rock. The cold night air woke Lhote a little later, and since the moon had risen he set off again, constantly setting his course by the compass.

About six in the morning he caught sight of the southern point of the Akarot Mountains, and two hours later was skirting the foothills. When he stopped for a rest at ten o'clock he had already advanced about forty-three miles. Late in the afternoon, after a good sleep and a meal, Lhote set off again —once more with Boubou on his back. By nightfall he had at last reached the mountain, and now the problem was whether or not to risk penetrating into the hills in the darkness and possibly getting hopelessly lost. However, he managed to find a pass, and when at last he could see no more he stopped in a little wadi, where he found a few dead shrubs: He lit a fire and lay down near it to get warmth from the flames.

About three o'clock Lhote suddenly woke up to find Boubou clinging tightly to him and gibbering as he did when frightened. The fire was out, and the clear moonlight was shining on the rocks. Then Lhote saw what had frightened his monkey. About a dozen yards away a hyena was glaring balefully at them. As quickly as possible Lhote grabbed for his automatic,

which was in his haversack, but the hyena promptly fled and bothered them no more.

Lhote decided to continue his march, and clambered over rocks and penetrated into a granite mountain range dissected by wadis in all directions. After he had scaled three rocky walls he could not decide which way to go, and then found to his consternation that he was gradually going eastward instead of westward. It was no good going on like this! But the trouble was that now he was fairly in the middle of the mountains, and could not remember which way he had come. Feverishly searching about him, he at last came across a path, and scrambled about on hands and knees, hoping to find traces of camels' hooves. At first he could only find the tracks of hyenas and jackals, but finally discovered traces of camels. They were evidently very old tracks, but they led to the west. He could not follow them for a great distance, but they gave him new hope that possibly that region was inhabited, and that with luck he might stumble across an encampment.

It soon became a rare test of tracking powers. He went along with his eyes glued to the ground, seeking the slightest indication of water. Often he stumbled or lacerated his feet on the sharp spurs of the rocks, and he frequently had to stop to repair his sandals. When he had to scale rocky inclines the straps of his haversack bit deeply into his flesh, and Lhote felt this was the worst discomfort of all.

Once he came to a wadi where there was a certain amount of vegetation, but soon afterwards he was crossing a stony wilderness again. Fortunately, it was cloudy, and this moderated the killing rays of the sun, so that he was able to struggle on until eleven o'clock before taking a rest. He still had plenty of food and half his water left, and felt in good trim.

About three he set off again—once more scrambling up rocky places. The footprints of animals became more frequent, and suddenly he came to a wadi where there were sudden sharp falls and flat sills. He had seen enough of the Sahara to know that a wadi of this kind usually held water—if there had been any rainfall during the previous four or five months. For an hour he followed the bed of the wadi without result, but hoping always for a bit of luck. Lhote wondered whether

A Papuan Man smoking a Bamboo Pipe

From "Papuan Wonderland," by J. G. Hides (by permission of Messrs Blackie and Son, Ltd.)

They promptly offered the explorer some milk, which he swallowed in great gulps. They too were astonished to see Lhote, and repeated, "Allah il Allah." God was indeed great, they said, to permit an infidel to travel such a distance on foot across such difficult country. Then they saddled a camel for Lhote, and late that night they reached the camp.

Two days later Lhote set off with a Touareg companion and two camels in the direction of Tin Zaouaten. They drove the beasts hard, and two days' journeying brought them to the old camp. Nothing had been moved, and the camel-driver had not returned. The poor fellow had got lost, and later on Lhote heard that he had been picked up in the last stages of exhaustion by a patrol from Kidal. Lhote left his baggage there, and pushed on to the well at Tin Zaouaten, where he found that a company of soldiers had been sent out to look for him. Their commandant had told them to take some canvas with them—not to act as a shelter, but for a shroud, so convinced was he that the lost explorer must have perished. As for the Arabs and Touaregs of the region, they were so astounded to see him return safe and sound that henceforth they called him "Ag Tenere" which, being interpreted, means "The man of the Tanezruft."

5

CONRAD KILIAN EXPLORES THE SAHARA

MONSIEUR CONRAD KILIAN, although by profession a geologist, has acquired the reputation of being one of the greatest explorers of the Central Sahara. By 1922 he had already earned high repute as a daring traveller by his exploration of the Ahaggar Mountains, but his greatest journey began in 1925 and lasted for three and a half years. For most of that time he travelled in the little known Tebou country, east of the Ahaggar, and his researches resulted in the filling in of one of the largest blanks in the map of the Sahara—an area not less than 200,000 square kilometres in extent. He discovered, amongst other things, a new plateau connecting the Ahaggar Mountains with the Central Plateau, and a great valley running from Southern Algeria towards the basin of Lake Chad. He was also able to throw some light on the old problem of the Garamantes who, according to Herodotus, drove four-horse chariots when hunting the famous Troglodytes. He not only brought back some carved Amazonite—the so-called ' emeralds ' of the Garamantian trade routes—but also pictures on rocks of the chariots drawn by four horses. Other pictures, showing oxen, were additional testimony that at one time the Central Sahara was a well-watered and fertile land.

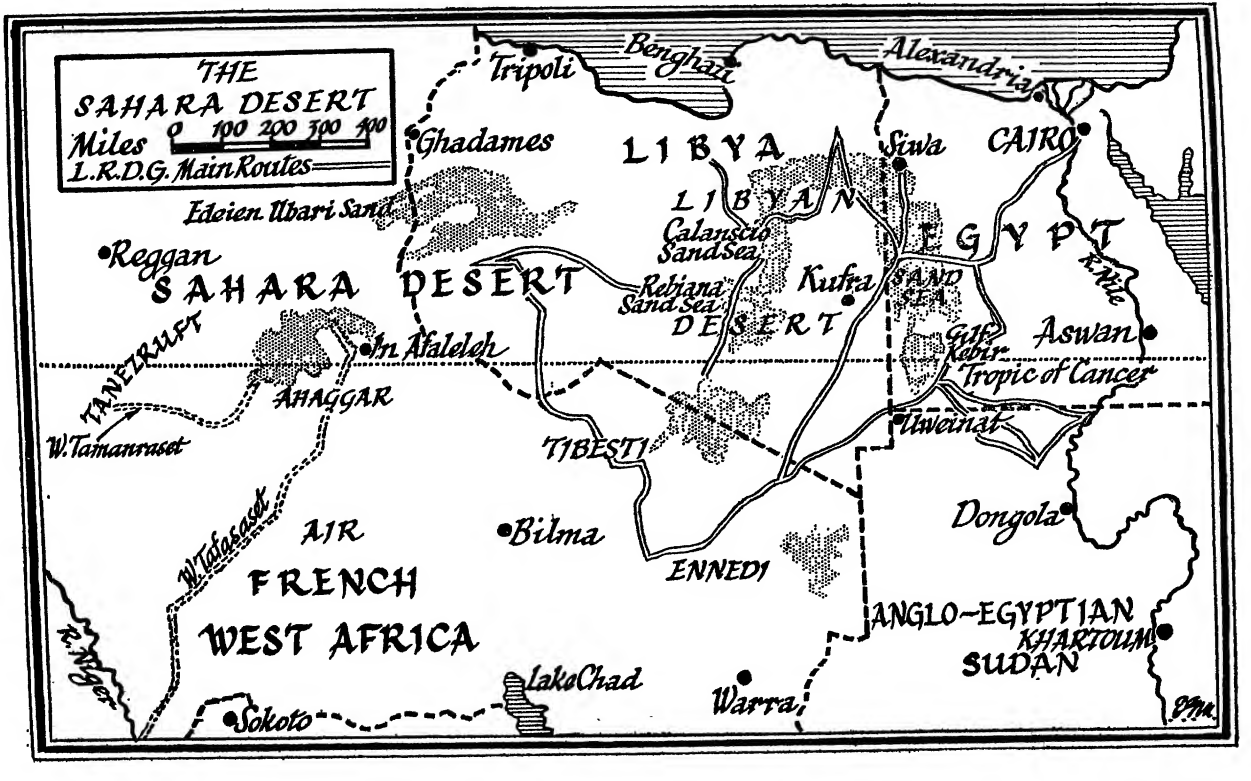
When he set off from the wells at In Azaoua he hoped to solve two problems of the Touaregs. The first was whether the great Tafasaset Wadi led to In Afaleleh, over a hundred miles away to the north-east; and the second, to decide whether there was any truth in the Touareg stories of the enchanted oasis of Tokalet. Two natives and five camels completed the party, and Kilian set off on a compass course for the nearest well. They had not gone far when they came across the mummified remains of some slaves, with the iron bonds still round their feet. What tragedy did this betoken? Once the slave traffic from the Sudan was the chief Trans-Saharan trade, and it seemed likely that these poor unfortunates had died of

thirst in a vain effort to escape. A little farther on, Mama, one of the natives, pointed out two beautiful acacias about which he told the following story. They were, he said, named after a man called Messak, who, when celebrating the great annual feast of Sebiba with his wife, had whirled round in giddy dances until he knocked over his water supply and so died. Thus at the outset Kilian had two reminders of the constant threat of death from thirst which menaces every traveller into the arid wilderness.

On every hill-top the explorer set up his plane table to make a map, and also found the altitude with his aneroid barometer. Soon he was in a granite country, full of rocky hills, and at such an elevation that it was clear the wadi Tafasaset could not have joined up the two oases as the Touaregs said it did. Although by this time the natives no longer knew the way, Kilian soon found clear traces of an old trade route. There were dozens of deep tracks which the caravans had trodden into the earth. What had caused the abandonment of this ancient thoroughfare? Mama thought he knew the answer. He had no faith in the "enchanted needle" of the compass and was soon quivering with fright and begging to go no farther. This was the land of the djinns, he declared, and the demons would soon enchant them or lead them to perish of thirst by some diabolical trick or other. There was only just time to get back to the normal regions, he said, and, having placed his share of the water on his racing camel, he prepared to leave the others to their mortal folly.

But Mama was the only one of the three who could recognize the wells at In Afaleleh, their destination, and so Kilian could not manage without him. Fortunately, El Bachir, the other native, had every confidence in the leader, and this made them two rifles against one. Kilian reminded Mama that he had sworn before his king, Amenoukal, not to desert, but even this did not stop the fellow from mounting his camel. Kilian and El Bachir loaded their rifles, and threatened to shoot the camel. This ultimatum had the desired effect, and Mama henceforth followed without trouble.

During the next few days it became clear that they were descending from the newly found plateau into a deep wadi


THE
SAHARA DESERT
Miles 0 100 200 300 400
L.R.D.G. Main Routes
Tripoli
Benghazi
Alexandria
Ghadames
LIBYA
Siwa
CAIRO
Edeien Ubari Sand
LIBYAN
Calanscio Sand Sea
EGYPT
Reggan
SAHARA DESERT
Rebiana Sand Sea
Kufra
SAND SEA
R. Nile
DESERT
Gilf Kabir
Aswan
In Afaleleh
Tropic of Cancer
TANEZRUFT
AHAGGAR
W. Tamanrasset
TIBESTI
Uweinat
W. Tafassasset
Bilma
Dongola
AIR
FRENCH
WEST AFRICA
ENNEDI
ANGLO-EGYPTIAN
KHARTOUM
SUDAN
R. Niger
Lake Chad
Sokoto
Warra

valley—the true Tafasaset—and it was running at right angles to the previously assumed direction. But by now ten days had passed, and it was absolutely vital to find a well before long. There was no green food for the camels, and already it was necessary to water their nostrils to allay their growing thirst. Towards evening Kilian climbed a hill-top with Mama, hoping that the native would be able to recognize the country he knew around In Afaleleh. Mama scanned the horizon long and anxiously. No, he could see no signs of the wells.

Kilian decided that they must march by night for a known high point near the well, from which, according to his calculations, they were not far distant. All the baggage that was not strictly necessary was dumped, because already one of the camels was stumbling, and its eyes were shrinking with dehydration. Kilian gave the unfortunate beast a bowl of water, and then they pushed on.

Reaching the high point about midnight, they followed along the ridge at the greatest possible speed, and the next morning sighted the dunes and tamarisks of In Afaleleh. Just in time! There were only two quarts of water left, and all the camels were in bad shape. But what had happened to the well? It was full of sand!

But what was that over there? A little heap of white sand on the black earth with a freshly cut tamarisk twig sticking in it! Kilian quickly grabbed the stick, and saw that there were some T'ifinagh (Touareg) hieroglyphics scratched in the bark. Feverishly he began to decipher. Before he had left Tamanraset he had sent out some Touaregs to make sure that the well was in good order—perhaps they had found a supply of water in a hollow not far away, and so had not bothered to clear the well. The first characters he could read said, "Salute to the French chief"—so it really was a message from the Touaregs, and he was filled with hope. But the next few words—deciphered with considerable difficulty—read, "Well too ruinous to attempt to restore it, thirst threatens, we are leaving. Good luck!"

Mama gave up the ghost. "Rlass [this is the end]," he said, "Our camels can never reach the nearest well, Tiririne, which is fifty miles away. And even if the camels could carry us we

have only two litres of water among three men, and that's not enough to last out." He reproached Kilian for having given the bowl of water to the dying camel, and then went off to lie down under a tree, like a condemned man awaiting the inevitable end. Kilian himself passed a blazing hour beneath the shade of a tamarisk, feeling that he too was facing death.

But the rest brought renewed strength. He sprang to his feet, determined to make a fight for it. Selecting the camel which seemed least thirsty, they cut its throat, and then, suspending its stomach on a tree, pierced it in several places with a sharp knife and extracted about two gallons of disgusting liquid. This liquid if consumed immediately is not dangerous, but it rapidly becomes a virulent poison, which has killed off many a traveller driven to this extremity. Kilian boiled the liquid and, having filtered it through a piece of muslin, obtained about a gallon and a half of water which tasted horrible but which was at least not dangerous.

The cool of the evening refreshed both men and beast, and they set off, alternately trotting and walking all through the night. They stopped once to make some tea with the good water, drank a copious draught of the camel water, and washed it down with strongly sugared tea. They ate nothing, lest that should make their thirst greater. By sunrise they had covered half the distance to the well.

But as soon as the sun appeared the camels grew thirsty again, and stumbled along with difficulty. " Rlass," said Mama once more. " They can't carry us much farther, and they will die before sunset. With what little water we have left we can't reach Tiririne on foot, because the slightest exertion will cause us to want more water."

By a miracle, no sooner had the native uttered these words of despair than they topped a rise and saw some magnificent gum-acacias a mile or so ahead. Now there really was a chance. The camels could shelter under the foliage during the burning heat of the day, and would be refreshed by the fodder.

In the evening they set off again, and in the middle of the night, when all the water had gone, Mama suddenly stopped and said that Tiririne well ought to be about there. But he could no longer find his bearings. The thirst and the fear of

the djinns had scattered his wits. Were the explorers to suffer the fate so often talked of by Arabs—to die within a few yards of a well? Kilian marched ahead, searching as well as he could in the dark for any traces, and at last found the promised well.

They rested for three days beside the refreshing waters, and then pushed on to the French post at Djanet, where the explorer was welcomed by his friends.

In the following spring Kilian returned to this same dreadful region, and successfully explored a great plateau previously unsuspected.

6

EXPLORING THE SAND SEA

BOUNDED ON the east by the Nile and on the west by the mountainous and thinly populated regions of Ennedi, Erdi, and Tibesti, the Libyan Desert is one unbroken tract of arid wilderness—by far the largest in the world. The whole area, which has as its centre the solitary mountain peaks of Uweinat and Kissu, is 1100 miles from east to west and about the same distance from north to south. Here and there, at intervals of several hundred miles, are small, uninhabited oases. Most of these are but a few acres in extent, and lie in deep depressions surrounded by cliffs. It is here alone that there are any signs of life—a few desert foxes, jerboas, lizards, and snakes.

Yet the Libyan Desert continues to attract modern explorers. There are still wide, blank spaces on the map which may conceal high plateaux like the mysterious Gilf Kebir, or oases like Kufra, and possibly the fabled treasure-city of Zerzura. There is much of interest, too, for the archæologist, since there is ample evidence that at one time this region—or parts of it—were a green savannah land, where neolithic man scattered his stone implements about. At Uweinat and elsewhere interesting rock-carvings and cave-paintings have been found, and there is even yet a chance that the relics of the lost army of Shah Cambyses may be found.

Twenty years ago the camel caravan was still the only recommended method of exploring the desert, but in more recent years the aeroplane and the motor-car have been used more and more. The most outstanding of the pioneers of motor exploration in the Libyan Desert is Ralph Bagnold. When stationed in Cairo he persuaded a number of fellow-officers to spend their leave in making experimental trips in specially adapted Fords across the deserts into Sinai and Transjordania. Then in 1927 they broke new ground by driving straight across country from Cairo to Siwa oasis, in the western desert. This trip involved creating a new technique, since they had

to provide petrol and water for the cars, as well as provisions for themselves. Water was the big problem. On the Sinai trip the cars had boiled continuously, and had wasted as much as two gallons a day. Bagnold overcame this difficulty by blocking up the overflow pipes from the radiators, and replacing them by tubes which ran from the radiator cap to a condensing-can carried on the running-boards. When the radiator boiled the cars could be stopped until they had cooled. Then the partial vacuum in the radiator would cause the water in the condensing-can to run back up the tubes, and in this way hardly any water was lost at all. Bagnold also perfected a sun-compass (a prismatic compass is useless in a steel car), and a system of steel channels and rope ladders for extricating the cars from deep, soft sand.

The Siwa trip was a great success, and it was then that Bagnold glimpsed for the first time the edges of the great Sand Sea, which had defied the efforts of all but a few explorers. He saw the long lines of dunes, with their pyramidal ridges raised three and four hundred feet above ground level. He also realized that, while progress between the dunes would be possible, it would be extremely difficult to make progress across the line of the parallel dunes.

Then in January 1928 he was requested to accompany a party of scientists into the desert south-west of Aswan, which had been explored in 1925 by Prince Kemal el Din and Dr Ball. Apparently, it had been reported by a geologist that on the fringes of the desert some locusts had been seen on the scattered palms and tamarisks. The expedition hoped to exterminate the young locust swarms before they could attack the fertile valley of the Nile.

Cars were taken to the oasis at Kharga by railway, and thence the expedition plunged into an empty world of rocks and sand to the southward. For mile after mile there was nothing to be seen but a vast sheet of shimmering sand, and mirages made even the horizon a vague blur. At last Bir Terfawi was reached, and here in a hollow were blue-green tamarisk bushes and a few unkempt date palms around a water-hole. The palms had been badly eaten by locusts, but the skins of the young hoppers on a patch of grass near by

showed the scientists that they had arrived too late to stop the threatened plague.

The next day the expedition set off south-eastward towards the old Darb el Arbain (Forty-day Road) slave track, stopping only to inspect the scattered bushes. Everywhere they found traces of the locusts, but at length decided that the swarm had flown southward towards the Sudan. At length they came to an old block-house on the slave road, and it was still possible to distinguish the wobbling tracks of the thousands of camels which once frequented the route. Sixty years ago it was no uncommon sight to see a caravan, with as many as a thousand negro slaves, plodding along this *via dolorosa* towards the markets at Cairo. Bagnold found that the route was well marked, for as far as one could see it was strewn with whitened heaps of camel skeletons.

After this journey Bagnold was transferred to the North-west Frontier of India, but he still felt the call of the Libyan Desert, and began to plan a new expedition when next he had leave. He bought a new Ford lorry, and in October 1929 set off with two companions, and drove all the way across Persia, Iraq, and Palestine to Cairo. Here he was joined by four stalwart companions and set off for the Sand Sea.

For mile after mile they wound round small dunes, crossed dried mud-flats, or snaked between gorges and pits in the wind-eroded rocks. At last they emerged on to more open ground of hard, grey rock spotted with pools of firm sand, and saw ahead, fringing the whole western horizon, the golden wall of the Sand Sea dunes. By noon they had reached the formidable barrier, and, leaving the cars on the hard ground at the foot, they scaled the highest crest. The sand piled so steeply that rivers of sand started to flow with every step they took, making it difficult to climb at all. The aneroid showed that the dune was well over 300 feet high. From the top of the dune they scanned the country beyond. The range on which they were standing was fully fifteen miles long, but they were encouraged when they noticed that it had a definite southern end. To the west lay several miles of flat, rocky ground and then another parallel range of sand. This too seemed to have a definite termination, and they began to hope that by winding

up and down it might be possible to penetrate the unknown area by keeping to the hard ground between.

The first range of dune was rounded without difficulty, but soon they were faced with another steep bank. No wonder previous explorers had reported that the dunes were uncrossable! Bagnold decided that everything depended on finding some way to cross the high banks of sand. He increased his speed to forty miles an hour, and charged straight at the side of the dune. The lorry tipped violently backward, and then to his amazement up they floated as smoothly as if they had been in a lift. Instead of sticking in deep, loose sand, as he had expected, he found himself very soon on the smooth top of the range. He stopped his lorry, and saw that his wheel-tracks were barely half an inch deep. Soon the whole party were safely on top, and, driving half a mile across a flat plain, they dropped down the western slope to the solid ground again.

In this way Bagnold discovered that the soft crests of the dunes are piled on the top of broad, whaleback humps of comparatively hard sand. Thus wherever there were no loose collapsing crests it was possible to advance across the line of the dunes—a feat previously considered impossible. Moreover, Prendergast, one of his companions, discovered that by deflating the tyres, so that they were flabby, the lorries could make good progress over comparatively soft sand. Gradually, however, the dunes became closer and closer until lack of supplies made it imperative to turn southward for the oasis at Dalla. Soon afterwards the gear-box of one car was smashed, but so confident were they now that they could conquer the dune country that they dashed to Cairo for a spare gear-box, repaired the lorry, and reached home again before their leave was ended.

For his next expedition—in 1930—Bagnold was more ambitious. He arranged for dumps of petrol to be set up at Dalla by camel caravan, and from that base struck across the Sand Sea, hoping to reach its western edge and then turn southward for the wells at Uweinat. He was accompanied this time by Newbold and Shaw, who had already become noted for their desert explorations. Once again they charged the sides of the dunes, and made good progress until they reached the route

followed by the German explorer Rohlfs when he first located Kufra. Bagnold made a petrol dump in the midst of the Sand Sea, and then went back to Dalla for more supplies. They were able to penetrate still farther into the unknown area until violent sandstorms and a succession of quicksands forced them to follow the line of the dunes towards Uweinat. There was no difficulty in making progress southward. They chose a track between two parallel sand ranges, and were soon speeding along a solid floor of black sandstone. Farther south the two dunes became higher and higher, their saw-toothed crests sweeping on in monotonous straight lines to the white horizon.

At length they sighted the first of the hills to the north of the Gilf Kebir and hoped that they had nearly reached the end of the dune country. But their troubles were not over yet by any means. The unending walls of golden sand on the flanking dunes grew closer and closer. Soon the narrow trough was choked with fine-grained sand, which slowed down the cars until all three sank to their axles in bottomless quicksand. They were trapped!

It was a difficult situation. They were at least two hundred miles from the nearest well, and the men were exhausted and very dry. Moreover, it seemed impossible to move in any direction except back along the track they had followed. There was one possible remaining chance. Perhaps they had passed unnoticed some break in the eastward dune, which would lead them out of the scorching cul-de-sac.

An extra ration of water had a marvellous reviving effect, and two hours' hard work saw the cars extricated and ready for further efforts. By great good luck, they had not retreated more than twelve miles before they found a chink in the eastward bastions, and so gained a wide corridor beyond. Now they could speed along once more, and by 4 P.M. they had cleared the last of the dunes. Forty miles farther on they came to the sheer cliff of the unknown plateau of Gilf Kebir. Unfortunately, they could find no way of getting their cars into this region, and so next day made for the wells at Uweinat. Here they had to abandon one of the cars, which had a broken crown wheel, but they found pools of real water, and discovered

several rock-carvings and pictures. They also encountered a solitary Guraan native, who told them that the total population of the district amounted to seven men. However, they could not stay long at Uweinat, and since they now were reduced to two cars they made straight for the Nile at Wadi Halfa via Selima Oasis—a distance of 470 miles.

In 1932 Bagnold and Shaw organized an even longer expedition to the unexplored regions south and south-west of Uweinat, in the course of which they travelled six thousand miles. At Uweinat they half expected to meet a gang of Guraan raiders, led by a villain called Gongoi, who had been active in the Sudan farther south.

But they found the mountain oasis deserted, and prepared to set off on a great southward lap across the greatest sand-sheet in the world to El Fasher. They made a petrol dump beneath the peak of Kissu, and found that often they could drive for hour after hour at 40 M.P.H. across the Selima sand-sheet. At Uweinat they came across a patrol of Italians encamped around a pool, and were also visited by a British aeroplane, piloted by the explorer Penderel. The Italians were evidently interested in these expeditions to Uweinat, since the mountain lies on the frontier between British and Italian territory. While there Bagnold and Shaw took the opportunity to climb to the 6000-foot summit of the main peak of Uweinat.

From Uweinat the expedition went to Sarra Well, and here, too, they found that an Italian patrol had been sent from Kufra to meet them. The officer in charge welcomed them, and regaled them with a Lucullan meal. Then they crossed a barrier of dunes into unexplored country between Sarra and the mountains of Tibesti, where loosely balanced slabs did much damage to the cars. At last they passed beyond the region of hard, jagged rocks, and finally reached the well at Tekro, thus completing the first crossing of the Libyan Desert from east to west. Then they retraced their steps to Uweinat, filled up with petrol again from the dump, and set off for El Fasher, 600 miles to the south in a straight line.

This trip involved crossing the area where Gongoi was reported to be, but the expedition was well armed with rifles and a supply of Mills bombs. When they reached the Mourdi

depression, where there were wells and grazing, they thought it wise to draw the cars up into a square, leaving gaps at the corners where two men slept with bombs and rifles ready by their sides, while an armed sentry kept a look-out. Next day they went downhill into the wadi, and found small patches of green scattered here and there. But they could see no signs of Gongoi's band, and when they came upon an addax antelope—the shyest of game—they knew that there were no raiders in the vicinity.

Farther south they began to run into patches of heskanit grass, and found that the tyres were becoming studded with the spiked burrs. The herbage thickened, oryx herds and gazelle became common, and they even saw flocks of ostriches. So at last they reached El Fasher, having crossed the desert from north to south.

On the return journey, after ploughing for a hundred and fifty miles through thorn thickets and miles of prickly heskanit, they reached the curious oasis of Malha, which lies in the bottom of an old volcanic crater. The wells and central lake were surrounded by steep walls of rock, down which tongues of treacly looking lava hung as if about to flow into the depression. Thence they reached the Wadi Hawa—marked by a long belt of low trees—and saw that along its banks the ground was strewn with stone implements—grinding stones and diorite axes. Here, where now there is no grass, man had once apparently thrived with his flocks. From this point the expedition visited three more uninhabited oases and so arrived at Wadi Halfa, after crossing several thousand miles of previously unexplored deserts.

During the Spring of 1938 Major Bagnold led yet another expedition to the Gilf Kebir. This time he was accompanied by expert archæologists and surveyors—among whom were Myers and Peel—and Dr Winkler, whose purpose it was to copy some of the rock-paintings from this region. Once again the waterless desert was crossed in big Ford cars, and a base camp was set up in a sheltered spot at the foot of the formidable 1000-foot cliffs. This time Bagnold hoped to explore the unknown interior of the great plateau, with its cliff frontage of

about 2000 miles. For several days it seemed possible that no way up would ever be found, until one day, by charging up a very tall sand-drift, they attained a small peninsula which was connected to the plateau mainland by a narrow neck. Here, on the flat and featureless headland, they soon found the stone rings, paths, and rock implements of ancient man. During the next few days the explorers were able to make an accurate map of the greater part of the plateau interior—using a sun-compass and the car speedometer as instruments.

Meanwhile the archæologists had made many interesting discoveries which seemed to prove that the area about the Gilf and near-by Uweinat was the centre of a flourishing Saharan culture, which probably terminated about 2500 B.C. Dr Winkler was able to make a fine collection of the rock-paintings, which are common in the caves about this region. The large numbers of cattle and giraffe paintings proved that the ancient people were cattle-breeders and hunters. One drawing showed a child playing with a tame ostrich. It is hoped that the discoveries in this field may throw much light on the early history of Egypt, and possibly too of South-western Europe.

During the war a great part of the Libyan Desert was explored by the Long Range Desert Group. This noble band of adventurers—Bagnold's "private army"—besides playing havoc behind the Italian lines during the North Africa Campaigns, made accurate surveys of previously unknown areas in the Sand Sea, the Gilf Kebir, and the difficult country to the west and south of Kufra. Bagnold's team included Major Shaw and the surveyor, Clayton, who had had great experience of motor travel in the Sahara during their previous explorations.[1] During the period 1941–43 Captain J. W. Wright, of the Sudan Defence Force, made valuable maps of previously unknown areas in the Uweinat-Kufra part of the Libyan Desert.

[1] For further information about this exciting story the reader should refer to the *Long Range Desert Group, 1940–43*, by W. B. Kennedy Shaw (Collins).

7

THE MYSTERY RIVERS OF TIBET

ALTHOUGH THE Chinese boast that their ancestors were creating exquisite vases when the Britons were still wearing skins, there are still large areas of their territory which are geographical enigmas. In particular does this apply to the maze of snow-capped mountains where the province of Sikang borders on Eastern Tibet. There are vast areas here, hundreds of square miles in extent, which have never been visited by Europeans, yet which veil secrets of tantalizing importance. In the region called Kam by the Tibetans four mighty rivers—the Tsangpo (Brahmaputra), the Salween, the Mekong, and the Yangtze, with its tributary the Yalung—cataract through abysmal ravines before bursting out into the plains of Assam, Burma, and China. At one point the rivers are so close that the Mekong is only twenty-eight miles west of the Yangtze and twenty miles east of the Salween, but they are separated by tremendous mountain chains, well over 16,000 feet high, and ravines 8000 feet deep in places.

Although the explorations of Kingdon Ward, Eric Teichman, Professor Gregory, and Dr Joseph Rock have done a great deal to throw light on these mystery rivers, large sections of their courses, and also their ultimate sources on the frightful Chang Tang of Northern Tibet, are still shown by a series of dots on the latest maps. Moreover, it is still not clear where the great Himalayan Range comes to an end—some think it sweeps far to the south, whilst others believe it extends eastward into China.

The Kam is in many ways different from the deserts of the Chang Tang, where Sven Hedin has so courageously explored, but even here robbers and horse-thieves are so prevalent that pack animals cannot be allowed to graze freely at night-time, and have to be picketed and guarded by ferocious Tibetan mastiffs. There are, however, many fertile tracts in the valleys, where the inhabitants can grow crops and tend their herds of

yaks. On some of the north slopes there are great pine forests, and there is plenty of game—antelopes, wild sheep and asses, black Himalayan bears, and snow leopards. Above all this is a wonderful district for the naturalist interested in Alpine plants, for this is the land of the blue poppy and the rhododendron.

Kingdon Ward, who is very probably the most persistent of living explorers, is primarily a botanist, and it is the wealth of new flowers and shrubs which has attracted him year after year into the tangle of mountains. In his search for new species he has been able to survey much previously unmapped land. On his 1913–14 expedition, for example, he crossed the ranges dividing the Mekong from the Salween and explored the granite gorges of the latter river. His task was made all the more difficult because the only guide he could find was a rascal called Atung. Atung was always causing trouble, and one day threatened to stab the explorer with the cruel-looking *dah* he always carried. Ward promptly punched his nose, and an ugly scene was only prevented by the intervention of two Tibetans.

A day or two later—when the guide's anger had apparently subsided—Ward sent him and his interpreter to the next village to collect porters. In the afternoon the interpreter returned and said that Atung had lured him on to a narrow precipice path; then, suddenly drawing his *dah*, had threatened him with instant death if he would not hand over the money for hiring the porters. Atung never turned up again, and when Ward arrived at the Chinese fort at Latsa the commandant sent out several soldiers armed with swords and ropes to capture the miscreant.

Ward plunged on into the granite gorge where the Salween cuts through the mountains. For a couple of miles the path, which wound through scrub forest about three hundred feet above the river, was easy enough. Presently, however, they came to a series of huge granite precipices. There were smooth walls twenty or thirty feet high to negotiate, and for the purpose the natives had placed long, thin tree-trunks with notches for steps and leading from ledge to ledge. Ward found that the first of these precipice ladders was jammed so tight against the

wall that it was impossible to get a grip on it with his fingers. Moreover, his boots slipped in the narrow notches, and for a few moments he feared he might be thrown off into the raging river below. The explorer decided that on the next ladder he would remove his boots, so that he could get some sort of a grip with his feet.

The next obstacle was a deep cleft spanned by two logs, lashed together with a creeper, and sloping steeply down to a ledge on the face of the precipice. He decided that this was no place in which to practise tight-rope walking, and, squatting down, crawled across.

That evening they came down through pines and ferns to the emerald green water, and then climbed upward again before camping. The next day he followed a path as difficult as the one he had found the previous day, and every now and again came to a tributary stream which cascaded hundreds of feet into the roaring Salween.

Late that afternoon they reached a sandbank where a canoe was drawn up, and sitting beside a fire was the crew—eight native women. The natives were, however, quite used to the rapids, and soon transported the explorer and his party beneath the towering cliffs to a pebble bank farther upstream. As soon as the canoe stuck the women jumped out into the icy water and towed the boat with a long rope until the shallows were passed. Soon they reached a sandy cove where they camped. Ward found that the canoe was made of a single hollowed fir-trunk about thirty feet in length.

The next day brought them again to dangerous rapids, and at one place they were forced to hug the shore, pushing against the cliffs with the paddles. The canoe seemed to stand still as the water boiled around them, until at last they reached a quiet bay and could take a rest. A little farther on they came to a waterfall, and had to haul the canoe out of the water to a safe point higher up. Soon Ward found himself in the Tsa-rong district, where he had made his base camp.

During his 1924 expedition with Earl Cawdor, Kingdon Ward had further experiences with the gorges of the Tibetan rivers. This time he explored fifty miles of the Tsangpo gorge—

a region which had for many years defied the efforts of all explorers. Yet it was an intriguing region, since at this point the Tsangpo, or Brahmaputra, makes a hairpin bend, and falls from a plateau 10,000 feet high to the Abor foothills—where it is little more than 2000 feet.

In between there are mighty mountain ranges, and it was thought that possibly there were tremendous waterfalls. Early in 1913 Bailey and Morshead, of the Royal Engineers, had tried to solve the problem. They set off from Pemakochung just above the gorges. Beyond the first waterfall, which was only 30 feet high, they found the route intricate and full of obstacles. There were great interlacing spurs, and they had to cut paths through dense thickets of rhododendron. Many times they were held up by rapid streams descending from adjacent glaciers, and soon food ran short. Morshead had to return with the coolies whilst Bailey, with one man and fifteen pounds of flour, endeavoured to push on. He soon found himself among the hostile Monba tribesmen, who refused to take him to their village and would not show him the way round some precipitous cliffs. It was clearly useless to proceed, and so there still remained fifty miles of unknown land and river beyond.

Kingdon Ward also set off from Pemakochung in an effort to fill the gap, and was more successful—perhaps because before setting off his men performed a good luck ritual by casting grain on a fire and marching round a temple. They had not gone far on their journey when it seemed that all further progress would be prevented by a vertical rock face. But three of the coolies managed to scramble up the cliff, and at the top they constructed a ladder out of two small trees. Although the crazy affair rested on a sloping ledge, the whole party, by remarkable good luck, managed to reach the top.

A little farther on they came to another cliff, and this time they had to hack a way through the scrub and descend to the river-bed. Then one of the men fell ill, but the prayers and crude doctoring of his comrades soon pulled him round. The main treatment appeared to consist of inhaling the smoke from burning bits of rag, accompanied by blows on the head with a rosary. Two days later they came to a place where the river

seemed to crash against a thousand-foot cliff, turn left, and then disappear. They hurried to the corner, their ears filled with the roar of surging waters. Was this the promised waterfall at last? There was indeed a cloud of spray with dancing rainbows, but after all the falls only measured forty feet.

Below the falls the cliffs on either side were so sheer and smooth that they could make no progress by the river-bed, and had to scramble up the cliffs and continue by the upper route. Hereabouts the scenery was so wild that Ward compared it to a lunar landscape. Next day Ward sent a messenger with an arrow letter to the up-river tribes, requesting transport and supplies. The letter was written on native paper with Indian ink, and was wrapped round a bamboo cane and decorated with two white feathers, which signified ' express.'

The next night they slept in a tiny village, and the following day crossed the river and climbed a long spur jutting down from the north. Their hunter-guides told them that there were big falls not far away, and once more their hopes were raised. Even before they got down to the river-bed they could hear the roar of tumbling water. They found that the river fell steeply, and then rushed headlong into a deep and narrow cleft. Trees were felled to make ladders, and from an elevation 100 feet up they looked into the cleft. The river was scarcely thirty feet wide, and must have been incredibly deep. A little farther on the water poured in a sleek wave over a ledge forty feet high, and then boiled up again to turn another bend out of sight. This was, as far as they could discover, the largest fall in the gorge, and so at last the fifty-year-old problem had been solved. Apparently the river falls steeply along the whole course of the gorges, and, though there are numerous small falls, there is no rival to Niagara as might have been expected.

During the course of his 1930 expedition Kingdon Ward, besides finding scores of new rhododendrons and Alpine plants, was able to throw some light on the old problem of the sources of the Irrawaddy. Accompanied by Lord Cranbrook—the zoologist of the expedition—he set off from Myitkyina (later to become so well known as a centre of fighting on the Burma Front in the Second World War), and followed the rough track through the jungle as far as Fort Hertz. Somewhere

away to the north-east, where Burma and Tibet meet, were the farthest sources of the great river.

A base camp was set up at the confluence of the Adung tributary among the primitive Daru tribes. Ward found that the price of a Daru bride was one or two *mithan* (cattle), several gongs and cooking-pots, or a gun and a knife. The men were naked except for a belt of cane rings round the waist, over which was draped a small square of cotton cloth. Every man wore a wooden sheath, supported by a string round the waist, which held a short hunting-knife. Most of them carried cross-bows, and seemed to be so short that they were almost pygmies. Their religion was a primitive animism; and their homes are merely square boxes of rough-hewn logs, three or four feet high, with grass-thatched roofs. Most of them were strong, but exceedingly ugly, and as dirty and unkempt as wild beasts. Even here, however, the women took some pains to make themselves attractive—they wore fine rings of lacquered cane round the calf, bead necklaces, and sometimes silver charm-boxes from Tibet. A good many of the women had tattooed their faces in a pattern of blue noughts and crosses.

Here and there in this district the explorers found settlements of Tibetans, some of whom had married Hkanung women. The Hkanung women wore Tibetan silver jewellery, set with coral and turquoise, but they still retained the three-inch-long bamboo-tubes in their ear-lobes. These tubes are plugged at one end, and are used as a sort of vanity bag to hold beads, needles and thread, or a leaf of tobacco. These girls too had tattooed faces—sometimes a few poetic lines and sometimes a variety of dots and dashes. From these Tibetan colonists, who were making hard efforts to tame the jungle, Ward heard of a previously unknown pass leading into Tibet.

At the beginning of May preparations were made for the journey from the base camp, up the Adung gorge, to the source. At this point the river is over 8000 feet above sea-level, and on either side are high Alpine ridges, averaging 17,000 feet. Eventually an advanced camp was set up at an altitude of 12,051 feet, and ahead rose the mighty mountain barrier which marks the frontier of Tibet. One day the explorers had visible assurance that there was a pass into Tibet when a gang

of ruffianly Tibetans appeared, dressed in ragged hempen gowns and bearing long, thin guns with pitchfork rests. They said they had come into the valley to collect the bulbs of a certain fritillary for medicinal purposes. After an opportune exchange of presents was made the trouble passed over, and, moreover, in the end the leader of the group promised to find some coolies and lead the expedition across the secret pass into Tibet.

Once over the pass, which was 15,300 feet high, Ward found himself in a beautiful valley, thick with gold saxifrages and gentians, and eventually reached a wide pasture where there were herds of yak, sheep, and goats. The herders were not very friendly, and one youth leapt on a pony and galloped off bare-back down the valley to inform the local ruler-priest. Eventually they were permitted to visit the village of Jite, which is close by the headwaters of the Irrawaddy, and there discovered that the furthest headwater of the great river is the Kalaw tributary, which rises in a range of massive snow-mountains. Beyond these mountains lies the basin of the Salween. Further exploration became impossible, because the Tibetans were unfriendly; so, reluctantly, the explorers had to make their way back across the pass and homeward through Burma.

Perhaps the greatest contribution which Kingdon Ward made to our knowledge of the geography of Tibet was his great journey along the Po Yigrong tributary of the Tsangpo (Brahmaputra) in 1935. Ward this time crossed the main Himalayan Range by two high passes, the Tulung La and the Pen La, on consecutive days. Both passes were over 17,000 feet and led to the bare, treeless plateau with its many small monasteries and chortens. The latter are shrines similar to pagodas.

Making his way slowly northward through difficult country, Ward finally reached the Tsangpo at the village of Lilung, and followed the right bank of the great river for some miles. Thence he struck boldly northward, seeking for a massive snow-range which he had sighted from a mountain-top during his 1924 expedition.

At the beginning of August the valley of the Po Yigrong

was reached, and there before him stretched the long-sought Snow Range, every peak and six complete glaciers being visible. Ward now decided to follow the Po Yigrong river to its source —a journey never before accomplished by a European. Before long he came to a deep, forested gorge and had to climb high up, so that he could only get an occasional glimpse of the river, with its raging mass of foam, as it tumbled over rapids and filled the gorge from wall to wall.

At length the end of the gorge was reached, and the native Pobas showed Ward how to get across the river on a rope bridge. The rope, which was about a quarter of an inch in diameter, was made of plaited bamboo, and supported a triangular sling of wood and yak hair. The passenger tied himself into this sling, and then hauled himself across the turbulent river. Beyond this point, deep down in the valley, there were a few scattered villages, but both to north and south there were mighty mountain ranges running parallel to the river.

When Ward reached the large village of Ragoonka he hoped that the worst part of his journey was over, but when he enlisted local coolies he noticed that they carried axes and long coils of new yak-hair rope. These ominous preparations were soon made clear when yet another gorge had to be negotiated. First they had to climb more than 1000 feet up the side of the cliff, and then descend down ladders made of notched poles to the river again. The gorge grew more narrow and steeper, and soon they had to climb again. Then came a giddy traverse across a smooth granite face into which six round foot-holes had been patiently ground. The porters, although they were carrying 40-lb. loads, stepped across nonchalantly, leaning slightly inwards, although one slip would have meant crashing to death on the rocks six hundred feet below. For once in a while Ward's heart failed him, and he felt utterly incapable of achieving the traverse until Tashi, his headman, rigged up a rope to give him the necessary ' moral ' support.

A littler farther on more rapids had to be circumvented by crossing a crazy wooden gallery built round the face of a vertical cliff. Ward tells us that it was " like a scenic railway at a fun city—without the fun." Parts of this gallery had been

washed away, and that evening the Tibetans spun a hundred-foot rope of split bamboo. Early next day the bridge-building began. Trees had to be felled to bridge the gap, and then the long rope was rigged up to act as a rope bridge, so that once more the river bed could be reached. Beyond this point the going became easier, and soon the explorer reached the glacier in which the troublesome river had its birth.

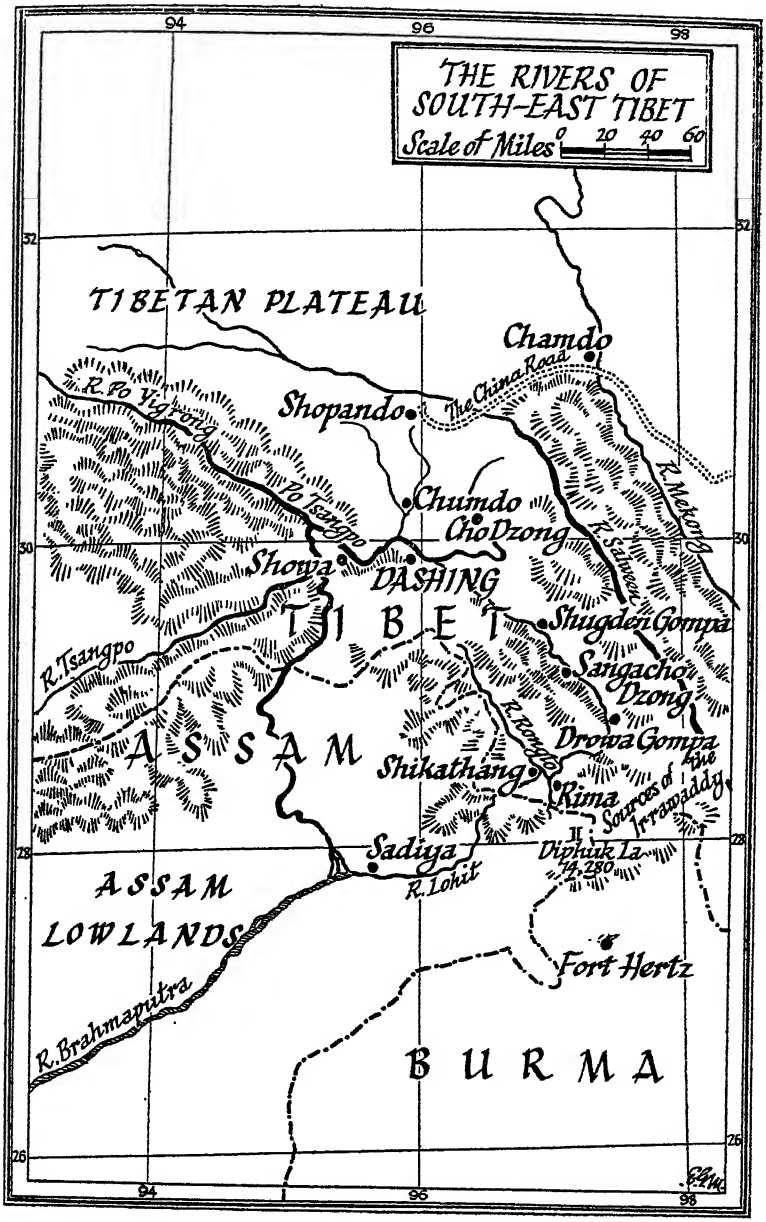
Now he was on the high plateau and could make his way southward over the Lochen La to Gyamda and country which he had visited on an earlier journey.

8

EXPLORING SOUTH-EASTERN TIBET

THE MAN-IN-THE-STREET is usually amazed to learn that it is possible in this year of grace to explore for the first time an area as large as Ireland. Yet such was the achievement of Ronald Kaulback and John Hanbury-Tracy, who during 1936 added to the map about 25,000 square miles of extremely difficult country in South-eastern Tibet. Kaulback served his apprenticeship as a Tibetan explorer under the wing of Kingdon Ward, whom he had accompanied to Zayul in 1933. Hanbury-Tracy, the other half of the expedition, was attracted to this mystery region by the fact that most of the great rivers there were shown as an intriguing line of dots, by the immense blank spaces shown between hypothetical mountain ranges, and by the fact that for some hundreds of miles the upper course of the Salween (called in Tibet the Black River) was entirely conjectural. Both of the men were agreed that it was distinctly remiss that so far nobody had determined where the Salween rose—that mighty stream which tumbles through the gorges of the eastern Himalayas, to meander for hundreds of miles across Yunnan and Burma.

They were lucky enough to secure the services of three Sherpas from Darjeeling. Lewa, their Sirdar, was the hero of the Everest and Nanga Parbat expeditions, and Nyima Tondrup had also won renown on the same field of honour. The expedition really started from the railhead on a bend of the Irrawaddy in the north of Burma, and from this point they journeyed along rough jungle roads to the Diphuk La, a high pass leading into Tibet. The worst trouble during these early marches along the dark, steamy paths was the myriads of leeches which festooned the trees and which found their way to their human feasts, even through the laceholes of their boots. There were deadly snakes too—like the Russell's viper; but Kaulback welcomed these to add to his scientific collection. After six weeks' travel through this type of country


THE RIVERS OF SOUTH-EAST TIBET
Scale of Miles 0 20 40 60
94
96
98
32
30
28
26
TIBETAN PLATEAU
Chamdo
The China Road
Shopandō
R. Po Yigrong
Po Tsangpo
R. Mekong
Chumdo
Cho Dzong
R. Salween
Showa
DASHING
TIBET
Shugden Gompa
R. Tsangpo
Sangacho Dzong
R. Rongo
ASSAM
Drowa Gompa
Shikathang
Rima
Sources of the Irrawaddy
Sadiya
R. Lohit
Diphuk La 14,280
ASSAM LOWLANDS
Fort Hertz
R. Brahmaputra
BURMA

they at last limped clear of the forest, and gazed on the gaunt peaks, the thin valley scrub, and the purple gentians of the Tibetan mountains. They camped that night in an ice-choked hut below the Diphuk La, and on May 26 at last walked 'off the map' across the 14,000-foot pass into Tibet.

For the next four days they scrambled over boulders in the valley of a stream called the Di Chu. There were bogs to circumvent, and rotting log bridges across wild torrents to cope with—arduous going in view of the fact that both the explorers were suffering from septic leech and tick sores. On the last day of the month they came to the fort (dzong) of Shikathang, where they were welcomed by a corpulent gentleman with a large homburg hat, who informed them that he was the secretary of the Governor. Later they met the Governor himself—a kindly official who wore a robe of plum-coloured silk. They explained that they wished to continue northward to the Salween through the unexplored province of Poyu. The Governor promised to send word to the headmen that they should be supplied with coolies from village to village. The next moment he alarmed them by announcing that on the first stage they would have to pay for a new rope bridge to replace one which had broken down. The bridge was seventy yards long! However, their finances were able to stand the strain, for the single rope of twisted strips of bamboo which was erected cost them precisely one-and-tenpence.

For the next four days the way led along the Rongto valley—through pine forests and past many a pile of mani stones [1] and many dome-shaped chortens where lay the revered remains of some holy lama. Once Hanbury-Tracy missed the way in the dark, and spent the night in a flea-ridden native-hut, where he was shown how to prepare *tsamba*, the national staff of life, and where he was entertained by a solo on a strident one-stringed fiddle.

Difficulties with porters delayed progress for some days, and they had to wait eleven days in a little village before they were able to pass out of the valley over a high glacier, only to find that another day's march brought them to a still higher pass

[1] A mani stone is a stone on which is printed (or indicated) a common Tibetan prayer.

—about 15,000 feet. On the sharp ridge at the summit the caravan was held up by a huge snow cornice which completely filled the gap. For an hour the coolies attacked the obstacle with swords and ice-axes, and at last a section broke away, and bounded down the slippery slope in a thunderous avalanche.

In the valley beyond they were privileged to meet the Lama of Sangacho Dzong, a very holy man who gave them much good advice. Then they marched northward into the unexplored province of Poyu, aiming to reach the Salween at Shopando, on the famous China Road. July 16 was a great day, for the explorers witnessed the elaborate ceremony of the " Great Prayer " in a temple of the Yellow Hat Lamas. The day began with a blaring of gigantic trumpets, followed by a vibrant drumming and chanting by the band of monks. One of them, resplendent in a multi-coloured silken robe adorned with writhing dragons and devils, went into a trance, and whilst he was in this state he made prophecies about the future. The climax of the weird rite came when the monk, roused to a demoniac fury, hurled a sword through the portals of the temple on to the paving-stones outside. Each paving-stone bore a mystical sign, and the monks—by noting at which point the sword fell—were able to read the omens for the coming year.

At Shugden Gompa the two explorers decided to separate so that they might explore both sides of a mountain chain, and thus add much new land to the map. Hanbury-Tracy found that the route he had chosen led him over passes higher than Mont Blanc and into the dangerous Poyu country. The path wound through gorges with sheer cliffs a thousand feet high, and at one point they had to creep along shaky galleries built out from the sides of the precipice and supported by horizontal wooden piles.

At last he reached a wide valley, where a headman told him that in winter the snow was so deep that the natives walked about on stilts. For a time it seemed likely that he would be marooned in this valley, for the exit on one side was barred by a repelling 500-foot ice-wall, while on the other foamed the Nyagong Chu, a tributary of the Brahmaputra.

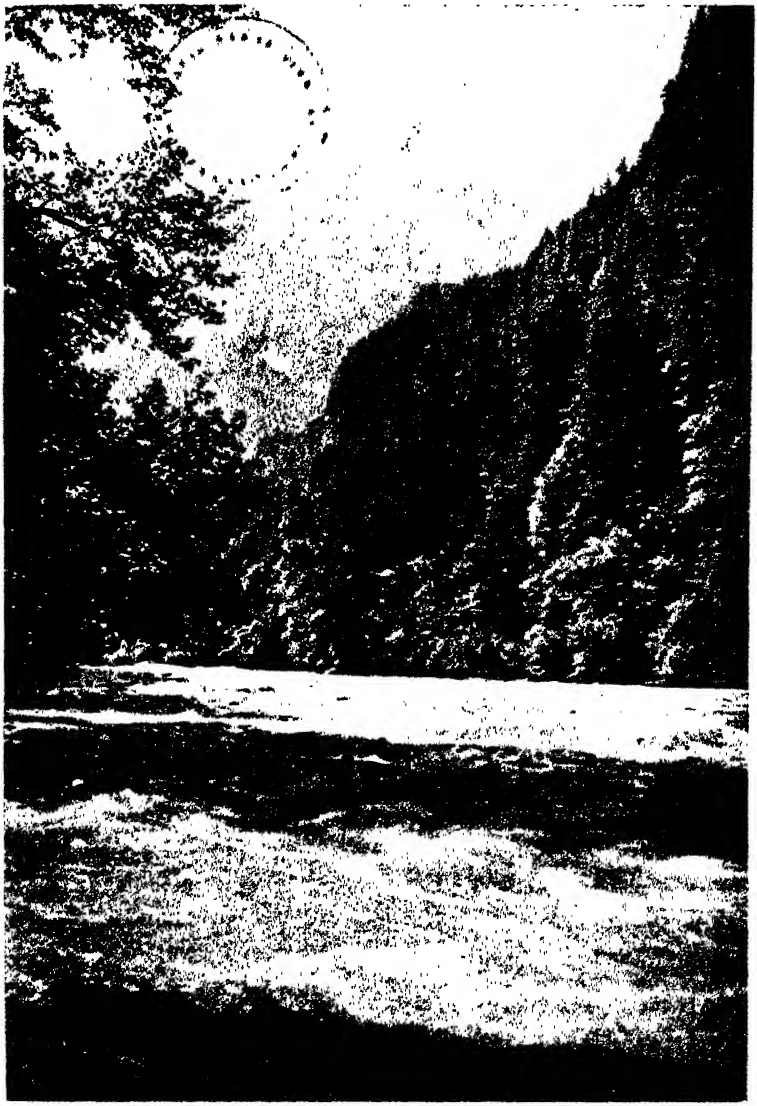
after pass, with only an occasional view of the great valley. At times the temperature sank to zero, and in one narrow gorge they crossed the river in single file on a great table of snow-covered ice, which stretched from one rocky precipice to the other.

But perhaps the most exciting experience came near the monastery of Chamda Gompa. They had just crossed a 16,000-foot pass when they noticed some remarkable tracks in the snow. They were definitely two-footed tracks, and, although slightly obscured by drifting snow, they bore a striking resemblance to those of barefooted men. There were five sets of them emerging from a gully and descending by a very steep slope to the valley below. The coolies at once said they were the tracks of the "Mountain Men," and told stories which resemble those told in other parts of the Himalayas about the "Abominable Snowmen." No solution of the mystery was forthcoming, since there are no bears in that region and the prints could not apparently have been made by a four-footed beast like a snow leopard. Is it possible that there is a race of strange beings inhabiting the roof of the world?

So far, to their surprise, they had found that the Salween valley was far from being uninhabited; indeed, they had run into a succession of monasteries, dzongs, and villages. However, the country was so difficult that they were only able to get a general idea of the course of the great river, and once spent some days investigating what proved to be a tributary. They spent Christmas Day in a monastery which was about ninety days' march from the nearest white man, and they celebrated the event with their last tins of peas and beans and a tinned Christmas pudding.

On New Year's Day 1936 they reached a dzongpon, called Naksho Biru, on the Black River, as this part of the Salween is called. Beyond this point the plateau was reported to be barren, and so before the final plunge into the unknown they retraced their steps, in order to fill in one or two blank places on the map, and returned to Naksho Biru a fortnight later.

In the meantime, however, the polite but suspicious Governor of the fort had come to the conclusion that the bearded strangers must be Russian spies. He argued that since Hanbury-



THE GORGE OF THE YIGRONG WITH THE GREAT SNOW RANGE IN THE BACKGROUND

[*See p. 72.*]

From "Plant Hunter's Paradise," by F. Kingdon Ward (by permission of Messrs Jonathan Cape, Ltd.)

There was no bamboo available for making a rope bridge, and he could not afford to buy enough yak hides to make a leather one. Then, by chance, he observed two natives—a man and a woman—attempting to descend the cliff-face. They clambered down a pitch of rock on to a narrow, sloping platform which ended in a lip, with a sheer drop of 400 feet to the river below. The man took off his felt boots, spread-eagled himself against the cliff, and wormed his way into an almost vertical gulley at the side of the platform. The woman followed him, and soon they had gained a grass-grown ledge, whence further descent was easy. Now came the problem: could the native porters be persuaded to tackle this suicidal route?

After four days of deliberation the local villagers agreed to make the attempt, and, grouping themselves on ledges a few inches wide, they lowered the loads from one to another with ropes. Two poles had been placed across the dangerous gulley, and Hanbury-Tracy crawled across these on hands and knees, with a persistent and well-meaning coolie firmly grasping the seat of his shorts. Somehow the whole party reached the bottom, and then took the main road to the next village—a 'main road' which included snaking along the gorge face on crazy galleries or ladders made of logs. At one dizzy point they looked down on the river 2000 feet below, while above them rose a further 2000 feet of precipice. At last, however, the twenty miles of gorges had been passed, and the way lay through an open valley with a village and wide fields.

A few days later Hanbury-Tracy reached the previously unknown capital of Cho Dzong, where he was well received and where he learned much of the geography of the surrounding mountain chains. Then he marched on to the main Salween-Tsangpo divide by a pass 16,383 feet high. At this point there was a remarkable change of scenery, for the narrow, wooded valleys and the glaciers gave way to open pasture land and barren, regular hills. The coolies said that the stream to the north-east led away to the Salween, the river whose source they hoped to find, whilst a trickle on the other side of the pass led down to the Tsangpo. All unawares, the explorer had stumbled upon one of the major geographical secrets of Tibet.

Returning through Poyu, Hanbury-Tracy made his way to a place called Dashing, where he had arranged to meet Kaulback. At last, after a three weeks' wait, his companion arrived, and reported that he had been held up by troublesome coolies. Then they began compiling the results of the two journeys, and found that altogether they had obtained a map of about 3500 square miles of previously unexplored country.

After spending a few days in the garrison town of Chumdo the expedition turned northward towards the Salween, and on October 20 reached the great China Road—one of the most ancient highways in the world, yet which so far had not seen any wheeled traffic. There were several very high passes to cross, but at last they reached Shopando, a market town, where they met Chinese caravans bearing tea-bricks and silks for Lhasa. Now and again a courier would ride post-haste into the town with a great clashing of horse-bells; or a minstrel troupe would announce their arrival by the beating of drums and cymbals. Inspired by the ceaseless ebb and flow along this strange highway, the explorers decided to begin trading in musk as a side-line. Eventually they made a 50 per cent. loss on their transactions—probably because they did not learn early enough that ' doctoring,' with pieces of liver, dried dung, earth, and even small stones, was an accepted factor in the trade.

While at Shopando they made their plans for the final journey which would take them to the source of the Salween, somewhere near the centre of the great plateau. They knew that this would involve crossing a cold, inhospitable desert where there were no villages and no food. They would have to buy yaks of their own, and enough food supplies to carry them as far as Leh in Ladakh. Then when all was ready they set off, riding along the rim of a valley into the biting winds of the loftiest plateau on earth. On the last day of October they gazed down on the blue-green Salween from a high pass. It had taken them seven months to reach the threshold of the unknown valley.

Twelve miles along the valley Hanbury-Tracy and Kaulback found that the narrow track ended in a series of steep-sided spurs, and so they had to turn aside from the river across pass

after pass, with only an occasional view of the great valley. At times the temperature sank to zero, and in one narrow gorge they crossed the river in single file on a great table of snow-covered ice, which stretched from one rocky precipice to the other.

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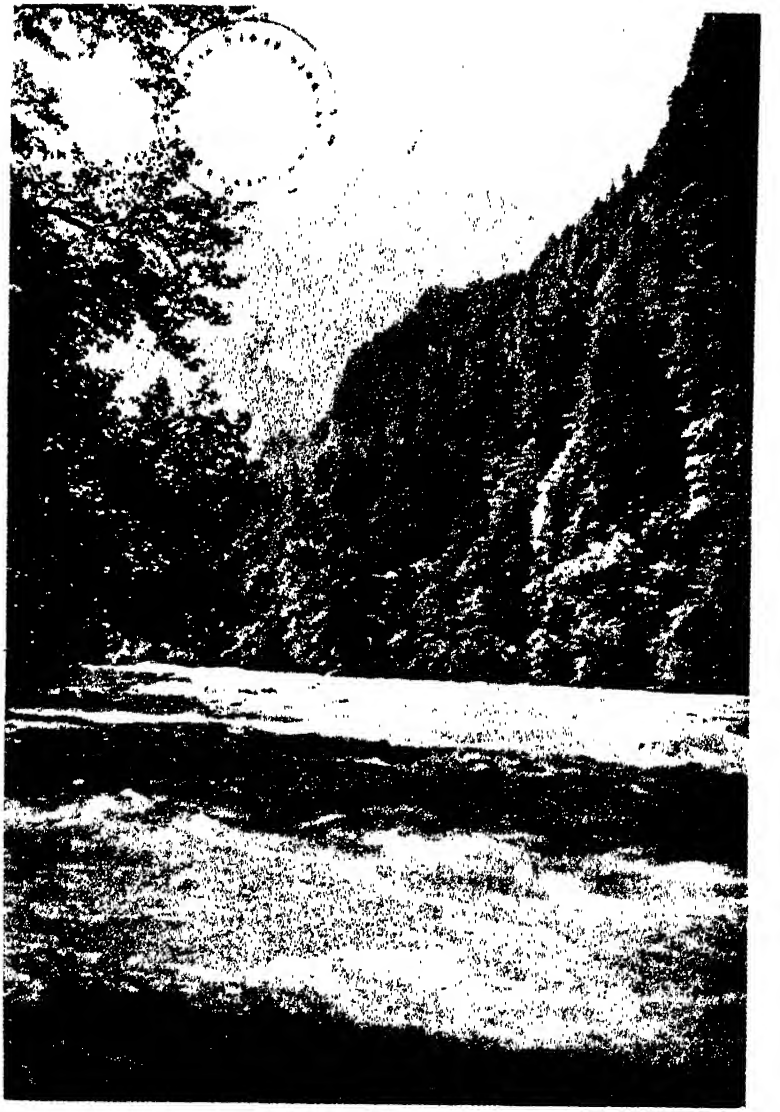

THE GORGE OF THE YIGRONG WITH THE GREAT SNOW RANGE IN THE BACKGROUND

[*See p. 72.*]

From "Plant Hunter's Paradise," by F. Kingdon Ward (by permission of Messrs Jonathan Cape, Ltd.)

ONE OF WARD'S PARTY CROSSING A ROPE BRIDGE

[*See p. 76.*]

From "Black River of Tibet," by J. Hanbury-Tracy (by permission of Messrs Frederick Muller, Ltd.)

Tracy wore a beard he must be a Russian who had come from the communist state of Szechwan, and that he was attempting disguise by wearing Tibetan clothes. He therefore told them that they must consider themselves under arrest until he could obtain instructions from Lhasa. This was a terrible blow. It would probably take weeks to hear from Lhasa, and it was useless trying to escape and venturing on to the plateau with only the three Sherpa servants. The Lama told them, moreover, that there were bandits roaming about the district. There was nothing to do but to possess their souls in patience until news came from Lhasa.

The long weeks of waiting were monotonous in the extreme. Two events livened the period a little. Once was when a great feast with devil-dancing took place; and the other—in the middle of March—when to their astonishment two Indian merchants arrived. These Ladakhis brought news of Europe for the first time in many months, and, being enterprising gentlemen, they had a large stock of manufactured goods—including a gramophone and, wonder of wonders, a cinematograph! The travelling showmen had a hilarious collection of pre-war French films which had been much patched, but which, nevertheless, appeared to the local peasants as a wonderful miracle.

On April 5 the long-awaited letter from Lhasa arrived, giving the explorers permission to move on. But now they had to decide reluctantly that the season was too far advanced to allow them to venture into the northern plateau. The wild Changpas from the far north would have reached the plateau with their herds of yak, and, since they are bandits, it would be dangerous to meet them. They, therefore, began the retreat from the Salween.

At Shopando they learned that there was a war on the frontier, probably with Chinese Reds from Szechwan. Bands of soldiers dressed in all manner of costumes were straggling along the China Road from Lhasa. This news meant a further alteration of plans, and they now decided to follow the course of the Salween as far as possible and so avoid the war area. From time to time they heard garbled accounts of the war, and one day met a young Tibetan officer on his way to the

front. He wore a gorgeous green silk robe, and carried a puce parasol, while riding behind him came his wife.

On the return journey, however, the two explorers managed to make maps of large areas which had not been previously visited, and, although they were diverted to the south again by the shifting of the war zone, they managed to make contact with the Salween again. Above all, by making no less than six crossings of the Salween-Brahmaputra divide they were able to solve one of the problems which have puzzled geographers for many years—namely, whether the Himalayas extend farther to the east or whether they make a great loop to the south.

9

THE YELLOW CRUISE
(CITROËN CENTRAL-ASIAN EXPEDITION)

NO ACCOUNT of modern exploration could be complete without some mention of the three great expeditions of Georges Marie Haardt, since they were in many ways the most ' modern ' of all. His first journey, or as he preferred to call it, cruise, was across the Sahara from north to south. The second journey, with similar equipment, was from Algeria to Madagascar (1924–25). But Haardt's third journey—the Yellow Cruise—was the most ambitious of all, since he proposed to cross the whole continent of Asia from Beirut to Pekin.

The journeys were inspired by M. Citroën, who was interested in the problem of heavy transport across difficult country. His factory had produced a special type of car, fitted with all-rubber caterpillar tracks, with a multi-wheeled bogey and a steel roller mounted between the dumb irons in front. This roller clears level ground by about eight inches, but when soft sand or other obstacles are met the roller lifts the front of the car so that the powerful thrust from the caterpillar tracks is all the more effective. Besides the fourteen special cars the expedition was well provided with winches, steel cables, derricks, portable girders, and so on, and they also carried short-wave wireless sets, an ambulance outfit, and even machine-guns. Incidentally, plenty of use was found for all the elaborate equipment, including the machine-guns.

Haardt hoped not only to explore new regions in Central Asia, but also to bring back a film record of the trip and a large collection of handicrafts and paintings.

After a great deal of difficulty permission was obtained from the several governments concerned for two parties to start. The party led by Haardt was to start from Beirut, while the other, commanded by Lieut. Point, was based on Peiping, whence it would move westward across Mongolia to meet Haardt's caravan at Kashgar, in Sinkiang. Incidentally, Point

had to promise to take a number of Chinese specialists with him to see that no economic exploitation was attempted! It was hoped that the two parties would be able to keep in touch with one another by means of the powerful short-wave sets they carried.

Haardt's group made excellent progress across Syria, Persia, and Afghanistan, although here and there swollen streams made it necessary to use steel cables and winches to haul the cars through. The end of the first three months found the expedition in Srinagar and now faced for the first time with really important obstacles—the Himalayas and the Muztagh. At the same time disquieting news was coming from the China group. They had already had trouble with Chinese politicians, and now the following message was received.

> Arrived Hami yesterday June 25th stop Passed through severe battle between Chinese troops and Muhammadan rebels stop Left Petro alone at Hami with a damaged lorry stop As soon as it is repaired he will join us in Kashgar stop Grave Muhammadan rebellion makes progress difficult stop V. Point.

But Haardt had plenty of troubles of his own to face. The route from Srinagar was the Gilgit road—actually little more than a narrow pack-trail barely a foot wide in places. It clung precariously to the sides of cliffs, overhung precipices, and dived into deep chasms before surmounting the 16,000-foot passes which connect the basins of the Indus and the Tarim. Experts were of the opinion that it would be impossible to get very far with the cars, but Haardt decided to make the attempt with two track-cars. The expedition was to divide up into three groups which were to start at intervals of eight days. A large number of porters and pack-horses were hired so that the expedition could carry on beyond the point where it might be necessary to abandon the cars.

They had not gone very far when the mechanics were busy jacking up the cars or hauling them by hand round the dangerous hairpin bends which coiled serpent-fashion up the steep mountain-sides. They had some anxious moments, too, on the flimsy bridges which spanned torrents roaring through deep chasms. Usually this involved unloading the cars, and then hauling them across by hand. But in five days they


"THE YELLOW CRUISE"
0 100 600
Scale of Miles
"Yellow Cruise"
KAZAKH
Aral Sea
CASPIAN SEA
L. Balkash
OUTER MONGOLIA
TURKMEN
ILEEK
Dchambul
Urumchi
TIEN SHAN MTS.
Turfan
GOBI DESERT
TEHERAN
Aksu
Hami
NINGSIA
Kashgar
TAKLA-MAKAN DESERT
Suchow
PERSIA
Herat
AFGHANISTAN
Kabul
Gilgit
SINKIANG
TSINGHAI
Tulan
Hangchowfu
KWEN LUN MOUNTAINS
Kandahar
SRINAGAR
Lahore
TIBET
SIKANG
ARAB SEA
R. Indus
Lhasa
INDIA

managed to advance sixty-five miles. This brought them to the Burzil Pass, which crosses the western end of the Himalayas, and here for the first time they had to contend with deep snow. Slowly the cars crawled upward at a mile an hour, since it was necessary to test the snow at almost every foot. Now and again the cars would lurch dangerously and threaten to slip sideways into an abyss, or to bury themselves in snowdrifts twenty feet deep. At last the top of the pass (13,775 feet) was reached, and the path dived down to the gorges of the Astor river.

While they were negotiating one of the narrow ledges overhanging this river Cecillon, who was driving the *Golden Scarab*, suddenly felt the road disappear beneath his near track.

"Ferracci," he yelled, "I'm sinking!"

"Don't move!" cried the leader.

Actually the leader was filled with terror, because the retaining wall had collapsed, and a whole section of the road had slid down into the precipice, leaving the two-ton car balancing on the edge of a yawning gap. Ferracci crawled to the edge to see what could be done and as he looked over his pipe fell from his pocket into the torrent hundreds of feet below. It took five hours of difficult work to get his companion safely back on to solid ground.

Two days later they reached Astor, a fantastic little hamlet perched up on a high pinnacle crowning the meeting-place of two gigantic gorges. Farther on the gorge became so narrow that only a narrow strip of blue sky could be seen overhead. Moreover, at this point recent rainfall had caused a landslide and left a steep slope of loose rubble a thousand feet high. The cars had to be let down by means of cables to the bottom of the ravine, and even there it was necessary to lever rocks to one side or else break them up with sledge hammers. It took a whole day to cover four miles. Even so on the next day further progress became impossible until both cars had been dismantled and divided up into 60-lb. loads. A line of panting and struggling coolies sidled over the shaky ground for two or three hundred yards before it was possible to reassemble the machines.

Five days later the track-cars were spinning along the flat

Indus valley within sight of Nanga Parbat, whose magnificent snow-clad summit burst into rosy flame in the rays of the rising sun. Two days later the caravan reached Gilgit, which marked the end of the journey by car. News had come that the China group was held up; Point had been imprisoned for some days and asked for intercession from Haardt. It was obviously imperative to hasten to Urumchi, and it would be far quicker to go ahead without the cars.

Beyond Baltit, where they were entertained by the Mir of Hunza, the valley narrowed down to a mere slit between wall-like precipices, and transport could only be carried out by porters. On and on the men toiled, in single file, until the Wakhjir Pass, where Russia, China, and Afghanistan meet, was reached. Beyond this point they began to meet the Kirghiz with their felt tents and sheepskin clothes and necklaces of braided yak-hair. Here in the heart of the Pamirs they had to rely on yaks for transport.

The defiles of the Himalayas, the Karakorum, and the Pamirs took sixty-five days to cross all told, and then at last the caravan dropped down into the level plain with villages, vineyards, and corn-fields, in the midst of which lies Kashgar. So at last Haardt's party had reached the appointed trysting-place.

But Point and the China group were still meeting all sorts of trouble, and had not yet arrived. They were held up at Aksu, three hundred miles away. Their last message to Haardt read, "Forbidden to go farther. Anxiously awaiting you at Aksu." The leader was, of course, eager to set off to meet Point; but the Governor of Kashgar seemed suspicious, and it was only after nine days of negotiations that a party escorted by ten soldiers was allowed to set off.

At dawn on October 8 Haardt's cavalcade were urging their tired mounts across the dusty plain when one of the men cried, "Look!" and pointed at a distant dot that rapidly grew larger.

"A Chanto," suggested some one.

"Have you ever seen a Chanto [native of Kashgar] in riding breeches and khaki shirt-sleeves?"

The solitary rider waved an arm and then his hat.

"It's Carl, my assistant, Carl!"

The rider came up and dismounted.

"Monsieur Haardt, here I am. . . ."

"Alone?"

"Yes, that is . . ." he stuttered in his excitement, "the others are at Aksu twelve miles away. The Chinese—well, we are under strict observation, but I managed to escape. A friendly Chanto lent me a pony at the last moment."

In this manner did the two advance parties meet in the very heart of Asia.

"Tell us about your journey," said Haardt.

Carl began to talk feverishly, and told a tale of constant dangers, obstructions, and perils.

Apparently difficulties had begun to crop up immediately after leaving Tientsin. The Chinese Press had been hostile to the expedition; and the Governor of Sinkiang had sent a warning that they might be attacked by bandits. Then, owing to a faulty adjustment, all the track-bands were broken, and they had to wait a few days for repairs. At one place a bridge was so low that the roadway had to be excavated before they could proceed; and at another the lorries were bogged in the bed of a river.

At length, however, they reached the Great Wall safely, and then had to wait at Kalgan for the party of Chinese scientists. Petro was sent ahead with two of the lorries, and as soon as Dr Tsu Ming-yi turned up Point ordered an advance to Peilingmiao, on the edge of the Gobi Desert. Here at last they were joined by the Chinese mission of eight members, two of whom were officers of high rank in the Central Chinese Army. They had brought great piles of luggage with them, and the first thing Point had to do was to explain that so much petrol would have to be carried for the desert crossing that only bare necessities could be taken.

The trail now led across great stretches of furze and barren plateaux, rocky gorges, and sandy wastes, where the only people they met were nomadic Mongols. One day the caravan got into a deep nullah, from which there was apparently no exit save over a vertical cliff. But their guide, Gombo, found some footmarks, and—knowing that wild animals always find

the easiest way to water—discovered a route which, with a little digging, could be made passable. Soon after this two of the Chinamen worked up a dispute with the Frenchmen, and, claiming that they had been insulted, returned eastward with a passing caravan. As the Frenchmen feared, these deserters did their utmost to raise a storm of troubles in China proper.

At the luxuriant oasis of Etsin Gol some of the lorries had to wait while Point and Petro went off to Suchow to obtain more petrol. Three days later the main body left the green tamarisks and poplar-groves of the oasis, and set off to meet Point, who by that time was expected to have obtained the petrol and to be returning. They had not gone very far when the men in the leading lorry saw, galloping towards them, a band of about a hundred horsemen. They were wearing uniforms, but, of course, this was no guarantee at that troubled period that they were not bandits. The leader drew up alongside, and when he saw that they were carrying cooking utensils and petrol he ordered them to unload at once.

"Are you alone on the road?" he demanded.

"No. There are six cars behind us."

"What sort of cars?"

"Armoured cars belonging to foreigners going on an official mission to Sinkiang. . . . There are two machine-guns in each car."

The bandit chief did not like this mendacious reply, and told them to load up again. At that moment the other cars appeared over a rise. Their drivers were, of course, not aware of any danger, and one of them actually rigged up his camera, and began to make a film of the scene. Suddenly, however, one of them noticed that all was not well, and gave the signal for rapid advance. It was none too soon, for the bandits were already beginning to look at their equipment with envious eyes.

At Suchow the expedition found itself becoming entangled in a typically Chinese political upheaval. The war lord, Ma Chung-ying, had ambitions to conquer the province of Sinkiang, and to establish there a Mohammedan empire. He had made an arrangement whereby his cousin, General Pu-fang, had occupied his territory round Suchow, so that he

would be able to concentrate his own troops for the conquest. It was quite clear that these conspirators would not welcome the intrusion of a group of foreigners equipped with wireless, who might broadcast news of their military activities. The position of the Chinese officers was also rather ambiguous. At first Ma Pu-fang ordered the wireless to be dismantled, and confiscated their passports; but at last permission was obtained to advance to a place called Hami if they would avoid the troubled area. Apparently the Chinese members of the Mission had turned traitor, and it was only by conceding that they should control the wireless and also the route that any further progress was possible.

The next five days passed without untoward incident, and the frontier of Sinkiang was reached. This portion of the Gobi proved to be more fertile, and in the mountains there were rich pastures where gazelles, ibex, mountain-sheep, and wild horses roamed about in great flocks. The members of the expedition wondered why there were no signs of cattle-raisers or hunters. They were soon to find out the unpleasant explanation.

Near a spring at the foot of a pass a wooden post had been set up. On it was written in Chinese:

> Danger! Don't go west. Hide your camels in the mountains and wait.

A little farther on they met a caravan, which had been sent ahead with petrol and supplies but had been delayed. It was decided that in view of the desert warning the caravan should halt and await instructions from the Mission when they had found out the situation in Hami.

On June 28 they drove into the first village on the outskirts of the oasis. The houses were in flames, and except for two excited natives the village was deserted.

"Don't go over there," they shouted, pointing to the west. "They are fighting. . . ."

"But who is fighting?"

"Everybody. . . ."

The explorers listened. They could hear a dull rattle which sounded like machine-guns, and then in the near distance the dull boom of artillery.

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> Danger! Don't go west. Hide your camels in the mountains and wait.

A little farther on they met a caravan, which had been sent ahead with petrol and supplies but had been delayed. It was decided that in view of the desert warning the caravan should halt and await instructions from the Mission when they had found out the situation in Hami.

On June 28 they drove into the first village on the outskirts of the oasis. The houses were in flames, and except for two excited natives the village was deserted.

"Don't go over there," they shouted, pointing to the west. "They are fighting. . . ."

"But who is fighting?"

"Everybody. . . ."

The explorers listened. They could hear a dull rattle which sounded like machine-guns, and then in the near distance the dull boom of artillery.

A few hundred yards farther on they found themselves on the edge of a battlefield. In the valley ahead there were at least a thousand soldiers, firing as they ran towards the surrounding hills, on which were groups of horsemen galloping about. The combatants were so amazed at the sudden appearance of the track-cars that for a few moments firing ceased. Then a Chinese officer came up and asked if they were the Sino-French Expedition. He then welcomed them to Sinkiang.

" What's going on here? " asked some one. " Whom are you fighting? "

" The Mohammedan dogs. But don't stay here—its dangerous—our colonel will tell you everything."

As the cars made their way slowly forward they could see that the battle was turning in favour of the Chinese, and soon the expedition doctor was busy attending the wounded. Then the Mohammedans counter-attacked, but were driven off again. Soon after this a mounted Chinaman galloped forward, and kowtowed to the leader of the expedition. He flung away his rifle and uniform, and stood revealed as one of their coolies who had been sent ahead with a supply caravan, but who had been conscripted.

" Don't be afraid, master; they won't find it," he whispered.

" Won't find what? "

" The petrol. I buried it! "

At nine that evening the expedition pitched its camp beside the city walls of Hami. The streets were mere rivers of mud, owing to the continuous trampling of soldiers hurrying to organize the defences. However, Point managed to persuade a powerful Mohammedan noble to give him a pass which would make it possible to proceed to Turfan. Petro had to be left behind with one of the lorries, which needed repair, and the rest pushed on and safely passed through the rebel lines.

Then came another obstacle. At Turfan an order arrived from the Governor-General of Sinkiang, commanding the explorers to go to Urumchi, the capital, instead of proceeding to the trysting-place at Kashgar. There was nothing for it but to obey. At Urumchi Point was received with a salute of guns, but this was merely an example of the Chinese custom—politeness first, business after—for when Point tried to open

the gates of the inn where the lorry had been housed he found his way barred by sentries. He was requested by the Governor-General to summon the remaining members who had stayed behind in Turfan.

For ten days Point was held prisoner before he agreed to send a message ordering the other lorries to come to Urumchi. Meanwhile the Turfan authorities had confiscated all the expedition's arms, with the exception of two light automatics which were artfully concealed under a trailer. When the Turfan party reached Urumchi they were met by an unshaven horseman who dashed out of the city and bade them halt. It was Point. He had been released when he had sent the required instructions to Turfan.

"Dismantle the track-bands and the running-gear," he commanded. "The Marshal wants to grab the whole of our equipment!"

Ten minutes later, when a breathless company of soldiers arrived, the cars were all sitting on their axles. The Russian chauffeurs who had been brought along announced that they could not put the cars in order. The exasperated Governor forthwith placed an armed guard over the cars, and the expedition was transformed into a detention camp. The motives for all this were somewhat complicated. The Marshal was short of transport for his campaign against the rebels. He also wanted the powerful wireless equipment. Moreover, the Chinese scientists had convinced him that the French were in alliance with the Mohammedan rebels.

Point now was in a desperate situation. It was most important that he should communicate with Haardt at Kashgar, yet all use of the wireless was absolutely forbidden. To communicate secretly by wireless seemed almost impossible, because the soldiers would hear the motors and see the aerial mast. It was a case of meeting guile with guile, and Point proved himself to be positively oriental in his ingenuity. He announced that in celebration of the National Day of the French Republic they would give a gramophone recital, and it would be amplified by using the current from the engines. A brave display of flags was also rigged up, and the wire to which they were fixed served as an aerial. A generator was hidden under

the front axle of the wireless car, and the cables were concealed under the chassis. At 8.30 one fine evening all was ready, and a large crowd of Chinese soldiers had gathered round the gramophone pick-up to hear the concert—the real purpose of which was to drown the noise of the wireless transmission. The engine snorted, and the strains of "Parlez-moi d'amour" floated out over the encampment. At the same time the click of the Morse key began.

One of the mechanics exclaimed loudly. The noise of the Morse code could be clearly heard punctuating the melody. He began to sing and shout, and was soon joined by all his comrades, until the tell-tale voice of the wireless was drowned in a cacophony of choral singing.

> FBQR from FPCG. Are held at Urumchi. Please intercede for permission to send three cars to Kashgar to meet Haardt's group. Governor threatens to requisition cars. Was personally held prisoner ten days. Victor Point.

The message flashed out to the ends of the earth. It was picked up, as we have seen, by Haardt, and also by a number of ships and half the wireless-stations in the Far East. The French Legation took prompt measures to clear up the incredible misunderstanding which had developed, and the Chinese Government gave permission for Point to continue. But the Governor of Sinkiang was very much of a law to himself, and it took forty-three more days of bargaining before he at last gave way and four cars set off to meet Haardt.

The caravan took eighteen days to reach Aksu, meeting thousands of soldiers being brought up to put down the revolt. Beyond this place they were not allowed to go, and the Chantos were forbidden to lend them animals. Nevertheless, Carl, one of the men, made a bargain with a native that the expedition doctor would treat his sick daughter if the native would provide a pony. Carl then rode out to meet Haardt, who by now, as we have seen, was approaching Aksu.

When the combined party arrived at the town Haardt was relieved to find that the four cars were quite safe and fit for service. Point, however, was not there. He had been obliged to go to repair a small wireless post at the headquarters of the

Chinese army, to the east of Urumchi. Point repaired the set, and then asked if he might go on to Hami and try to rescue Petro, who had been besieged there for some weeks.

"Have you a pass?" asked the General.

Point produced the special *laissez passer* signed by the Governor. The General, however, tore it up without even looking at it.

"You will remain here as long as I consider necessary," he growled. Point was prepared for something like this, however, and with a flying leap jumped out of the window and clambered aboard the lorry, which drove off at full speed. Before long they reached an oasis where there were thousands of corpses—all that remained of General Liu's army. They began to climb up a slope between two walls of rock. Suddenly shots rang out. They had run into an enemy ambush and had to retreat to army headquarters again. The General sarcastically welcomed them back, and Point had to repair his wireless again. Next evening Point escaped again, and eventually turned up at Urumchi, having decided that he had not enough petrol to reach Hami and rescue Petro.

At three o'clock in the morning of October 21 the explorers heard a violent knocking on the door of the house they had occupied in Urumchi.

"It's Petro," cried Point, jumping out of bed. "I know his voice!"

It was indeed Petro, whom they had not seen since they left him at Hami with the damaged lorry four months before. He had found a blacksmith who had forged a new clutch-case, he said. On the day after his companions had departed Petro had been awakened by a frightful uproar, and from a dormer window had watched the rebels attacking the city. The steep bank outside the walls swarmed with men—many of them Chinese peasants, carrying scaling-ladders, who had been impressed and were now being prodded on by Tungan soldiers armed with huge curved swords. In spite of a furious bombardment by the defenders, ladders were placed in position, and hand-to-hand fighting with pikes and axes began on the battlements. Then quite suddenly a machine-gun came into action, and in a few minutes the attack was repulsed. At dawn

the Mohammedans had retreated, but there were still enough snipers in the vicinity to make a sortie dangerous.

Nevertheless, Petro attempted to escape, and was promptly captured by the rebels. Fortunately, the rebel Chief of Staff took charge of the prisoner, and he was well treated and eventually sent as an envoy under escort to the besieged city. Petro crossed no-man's land waving a white handkerchief, and was admitted. The Defence Council plied him with questions about the enemy, and refused to consider the terms of capitulation. Since there was not much forage left for the animals, it was decided that somebody must lead a sortie and drive the Mohammedans away. However, nobody seemed anxious to have the honour of leading the sortie, and the Council came to an end without any decision having been made.

The initiative thus passed to the Tungans, who a fortnight later fired a mine under the walls, and made a great breach. By a bit of luck one of the Chinese officers had the place covered with a machine-gun, and the Tungans were driven back. Petro was then requested to give advice as to the best method of preventing mining, and suggested that if he were provided with a blacksmith he would find a way. The blacksmith was forthcoming, but instead of being used in the defence scheme he was given the job of repairing the broken clutch casing on Petro's lorry. Fortunately for his little scheme, Petro really had a good plan for stopping mining. He gathered a crowd of the defenders and made them dig a trench inside the wall to below water level. Since the rebels had no pumps their galleries were flooded, and their mines made useless.

The siege still went on, however, and the garrison were soon starving. All the animals were slaughtered, and the men were sustained by opium. Petro managed to survive by catching pigeons under the eaves of his house at night with the help of an electric torch. When the situation became really desperate Petro volunteered to try to escape and summon help from Urumchi. He found out from a couple of prisoners that there were only a small number of troops still around Hami.

Petro decided to take the risk of breaking out one night, and then, by hiding in the desert in the day-time, work round the enemy lines. The plan was accepted; and on the night of

the hundred-and-ninth day of the siege a company of soldiers, working feverishly and in complete silence, made a breach in the walls, and Petro set off. They had not gone more than a couple of hundred yards when the lorry stuck in the soft sand, and several shots were fired at them. Petro and the three men who had been sent with him sprang out, and dug away for dear life to free the wheels. Then on they churned again, only to find the way blocked by the vague outlines of a troop of cavalry. Petro switched on his powerful headlights and made straight for them. The horses, blinded by the sudden glare, scattered in all directions, and in a minute the lorry had dashed through. Some miles farther on they had to hide in a ravine whilst a detachment of troops, camels, and carts passed by, but by daybreak the lorry was safely hidden in the desert.

Three days later, after wandering blindly over dunes, salt marshes, and ravines, they were still in the desert, and had only half a cup of water per man left. Then came a sandstorm which raged for hours and threatened to bury them; but on the next day they reached a small oasis outside the rebel zone. On the following day Petro had arrived at Urumchi.

So at last on October 27 the whole of the expedition was housed for the first time under one roof. Now, thought Haardt, it should be an easy matter to continue with our explorations. But another month of tedious negotiations passed before the Governor finally gave them the *huchao*—their passport to freedom.

The archæologists of the expedition forthwith went off to the Turfan basin, and made some important discoveries among the ruined cities on the ancient silk route across the Gobi. Then the explorers turned south for the chain of oases lying south of the Gobi, at the foot of the Nan Shan mountains. This involved passing through Hami—which by this time had been relieved—where they found that all their dumps of petrol and supplies had disappeared. Fortunately, they remembered the message brought by the coolie who had been conscripted for the defence of Hami saying that the petrol had been buried somewhere in the desert. This involved a detour, but at length the cache was found.

Haardt then decided to strike across a large unexplored area

THE "PENOLA" FROZEN IN DURING THE BRITISH GRAHAM LAND EXPEDITION

[*See p.* 186.]

Photo W. L. S. Fleming

From "Southern Lights," by J. Rymill (by permission of Messrs Chatto and Windus, Ltd.)

CUTTING THE ICE TO FREE THE "PENOLA"

[*See p.* 186.]

Photo A. Stephenson

From "Southern Lights," by J. Rymill (by permission of Messrs Chatto and Windus, Ltd.)

in the foothills of the Mongolian Plateau. This was indeed a brave gamble, because by now winter had frozen the countryside, and it was imperative to keep the engines ticking over or else they would have been completely frozen up. At nighttime the temperature was 20 degrees below zero, and they found that even boiling water froze when poured into the cold engines. If they could not find a track across the unexplored territory they would soon run out of petrol and that would have meant dismal failure.

Fortunately, the guide, Gombo—who had been taken along not because he knew the way but because he so thoroughly understood all the tricks of the desert—found a route which brought the nine metal monsters safely to the main camel road to Suchow. On they crawled through the frozen heart of Asia suffering severely from the cold, but driving onward for twenty hours out of the twenty-four. For six days they travelled without seeing a solitary human being, until at last, on December 18, they reached Suchow.

Here there was a further delay until more 'squeeze' had been extracted by the Colonel in command, but New Year's Day found the expedition at a Christian mission at Liangchow, 250 miles nearer journey's end. For the next three weeks the expedition was crossing through the loess country of Kansu and along the left bank of the Yellow River, and apart from one or two serious breakdowns had a comparatively uneventful journey. Then, however, they once again reached an area where banditry was common, and not far from Wu Yuen they were ambushed. The explorers returned the fire with their two machine-guns, and the place suddenly became empty. Presently a Chinese soldier advanced with a flag of truce—a basket on a long pole—and explained rather inadequately that the expedition had been mistaken for bandits. The explorers did not wait to argue the point, but drove on into the darkness as quickly as possible.

Two weeks later, three hundred and fifteen days after leaving Beirut, the expedition drove along a well-paved road into Peking. They had travelled 7219 miles. The French Legation gave them an honourable welcome; but soon they began to plan a return journey through Siam and India, which would

mean taking a sea trip to Haiphong. They were all looking forward to a victorious conclusion to their epoch-making journey when sudden tragedy put an end to the whole scheme. Haardt was stricken with double pneumonia and died at Hong-kong. André Citroën asked that the leader's body should be brought home.

" The man is dead," he wrote, " but his work lives."

10

SIR ERIC TEICHMAN'S JOURNEYS

ONE FEBRUARY day in 1919 a ragged caravan was toiling along the last stages of the great Tibetan North Road towards the frontier town of Tachienlu. The trail was black with yak caravans, carrying tea in the opposite direction into Tibet, but the east-bound caravan took little notice of them. Most of the motley crowd were ill-clothed to withstand the arctic temperatures of the trail, and several were forced to walk because they had lost their ponies on the arduous mountain passes. They looked what they were—stricken refugees from a battle area.

At their head marched a sturdy Englishman called Eric Teichman. A consular officer in the British Service in China, Teichman had been sent into Tibet a year before to act as a mediator in the savage war of independence which had broken out between the Tibetans and the Chinese. Now he was returning to Tachienlu, having carried out his mission successfully, accompanied by a number of Chinese who had found they were no longer welcome in the land of the lamas. Moreover, in the course of a journey of 2677 miles Teichman had been able to explore many regions previously unvisited by Europeans.

When Teichman set out on his expedition he knew that he would have many difficulties to face. Four years previously the Chinese had suppressed an insurrection in Eastern Tibet with great severity. Above all, they had destroyed a number of monasteries, and the Tibetan lamas were thirsting for revenge. The subject population had many grievances against their celestial overlords, and were everywhere in revolt. There was news of Chinese armies which had been wiped out or which were closely besieged.

In order to avoid the main scene of fighting Teichman had to make a series of wide detours. For the first two hundred miles he followed the She Chu river, and then crossed a 13,000-foot pass to Kanze on the Yalung river. Here he found there was a great monastery. A cluster of red and white buildings

encircled the gilded roofs of a temple, and all round stretched a mighty frame of snow-covered mountains. Besides the thousand lamas housed in the town, he found two companies of Chinese troops waiting to be sent westward to relieve the besieged garrison at Chamdo, on the Mekong river. A refugee Chinese had just arrived with the news that one Chinese garrison in the interior had been wiped out, and that all the provinces to the west were preparing for revolt.

This meant that Teichman had to strike north-westward into unexplored country, so that he might march round the disturbed area to reach the Tibetan base. For about eighty miles he followed the Yalung up a narrow gorge into the mountains. The Yalung here was a deep dark-green stream, fifty yards or so wide and swirling with blocks of ice. From a place called Nando Teichman struck across the mountains over a 14,000-foot pass into the valley of the Yangtze, which he found flowing in a deep canyon some 2000 feet below the trail.

Two days' march brought the caravan to an important monastery called Seshu. As they approached the holy place they could hear a great hubbub among the lamas, accompanied by shots and the blowing of trumpets. Then Teichman caught sight of a band of armed horsemen driving a herd of ponies across the plain towards the Yalung. The enraged lamas explained that the thieves were wild brigands from the plateau, and asked Teichman to help them in firing on the miscreants. However, the robbers soon disappeared round a corner of the mountain, and the lamas gave up the case. They said that the brigands would return the ponies when they were given presents. In the disturbed conditions then prevailing raiding was quite common, and henceforth the explorer found it safer to picket his animals every night and set Domna, his big black mastiff, on guard.

Teichman now marched in a wide sweep through wild country to Jyekundo, a village of mud hovels but the most important trading centre in Eastern Tibet. Here the Yangtze flowed at 11,800 feet above sea-level—a clear blue stream, two hundred yards wide and hemmed in by steep mountains rising thousands of feet from the water's edge. He learned that the

Chinese garrison at Chamdo was still holding out, and that, by crossing the unknown country to the south, he could reach the town safely, and so get an interview with the Tibetan commander, called the Kalon Lama.

The way led up a gorge into the heart of a big snow range. Then a two-hours' struggle up a very steep slope through deep snow brought the caravan to the Shung La Pass. At such high altitudes men and animals found it difficult to advance at speed; and one mule died.

Over the pass they met some nomads—their brown faces almost hidden with dirt. They all wore silver and coral earrings, charm boxes slung round the neck, and a sword thrust crosswise through the girdle, but their sole garment was a greasy sheepskin robe. Some of the women had made their faces hideous by smearing them with black grease to protect themselves against the fierce winds.

Just before Teichman reached Chamdo some Lhasa soldiers came galloping up and announced that Chamdo had fallen. The town—which lies at the junction of the Dza Chu and the Ngom Chu, the two headwaters of the Mekong—had been easy to surround, and at last the garrison had surrendered. The next day Teichman interviewed the Kalon Lama, who was a middle-aged monk of commanding stature and great intelligence. Eventually he agreed to arrange a temporary truce so that the Englishman could arrange peace terms with the Chinese commanders. Teichman saw that the prisoner Chinese were well treated, but that there was a serious lack of medical attention. He, therefore, sent a messenger to the nearest medical missionary for help.

Then he had to return to the Chinese base, and for some distance travelled with the advancing Tibetan army. These soldiers from Lhasa resembled a migrating Tartar horde; and the narrow trails were often blocked by their trains of yaks laden with women, children, tents, and household goods. The Dabon, or general, was richly attired in silks, and mounted on a fine mule. He had a bodyguard of cavalry, and was preceeded by standard bearers, trumpeters, and men playing the national instrument—the bagpipe.

Teichman's own party was now swelling with the crowd of

frightened Chinese merchants and settlers who had attached themselves, thinking that the mediator would see them safely through the enemy lines. With their wives, children, and baggage, the train covered many miles of road, especially since many had no pack animals and straggled in the rear. Many of them, too, were in a state of semi-collapse, owing to the hardships they had undergone, and beseeched the explorer for more "*sinico*" (medicine) to cure the "*huo*" (fire) in their insides.

Eventually Teichman encountered the Chinese commander, and was able to arrange a further truce. Then he travelled on to the Yangtze with his crowd of refugees. Near Batang, on the frontier, he found that the Yangtze flows through a colossal canyon which rises some seven thousand feet almost from the water's edge, and the tributary streams came cascading down the precipices from high, ice-formed hanging valleys. At Batang Teichman heard that fighting had begun again, and so had to return the two hundred odd miles to Chamdo with the Chinese terms for a final peace.

While the negotiations were proceeding he was privileged to see the Tibetan theatrical performances in celebration of the first day of the seventh moon. The stage was an open piece of ground in front of the Kalon Lama's house, and the Tibetan soldiers, who did the acting, performed from eight in the morning until dusk. Since the players frequently refreshed themselves with copious draughts of *chang* their acting gradually became more and more lively as the day wore on. The play was a sort of musical comedy, and there was a good deal of singing, dancing, and clowning. The plot was concerned with the love affairs of a Tibetan king who had much trouble with his two wives. The proceedings ended with a bonfire of juniper bushes, and the presentation of parcels of tea and barley-meal to the actors.

Teichman's next journey was to Rongbatsa, where a Chinese and a Tibetan army were facing one another; and it was his job to arrange a mutual withdrawal of troops. Once again he found his caravan encumbered with a crowd of refugees, but he managed to get safely through the fighting-lines and arrange a withdrawal of troops. On the return journey he

explored a large area in the Gonjo province, although this involved crossing the Yangtze-Mekong divide once more, over passes 16,000 feet high. When the Yangtze was reached he had to march along a narrow footpath a couple of hundred feet above the river. At one point a pony slipped over the edge, and rolled down the precipice, scattering the small remaining stocks of candles and sugar on the stony beach below. Eventually, by climbing through pine-forests and in and out of tributary ravines, Teichman was able to put a big tributary —the Re Chu—on the map.

Later on he marched down the Mekong into Tsawarong province and on to the Yunnan border, through beautiful pine-clad scenery with enormous snow massifs always in sight. Everywhere he was welcomed as a peace-maker, and when he reached Batang once more was surrounded by refugees who begged him to escort them on his homeward journey to Tachienlu.

The route—along the main South Road—led up a narrow rock ravine to the east, and then up a long climb through pine forests to a 17,000-foot pass. Progress was slow, because in places the trail was obstructed by barriers of felled trees and other obstacles, placed there by the Tibetans to hold up an advance by the enemy. Some of the obstacles looked suspiciously new, however, and Teichman feared that his caravan would be attacked by brigands before long. Sure enough, they had not gone far when he heard a prolonged fusillade down in the forest below. As the armed party were leading the way Teichman realized that the refugees were being attacked in the rear, and sent some of the more active men to the rescue. Some distance down one of the mule-drivers came up with the news that the caravan had been ambushed, and that several of the Chinese refugees had been shot, and all the mules driven off with their loads. Teichman realized that the position was serious, since this meant he had lost all his baggage, tents, silver, and ammunition. He spurred his men on, and soon they reached a clearing, where a confused mob of mules and ponies were wandering about with their loads strewn on the ground. Teichman's armed men opened fire on the brigands, who were taken by surprise and fled without putting up any

resistance. Fortunately all but two of the ponies were recovered, but the losses involved a return to Batang.

A few days later Teichman set off again—this time by the North Road, since it was reported that in that direction there were not so many brigands about. Once again, however, when they were half-way up a wooded pass the slower moving yak-section was attacked. Once again Teichman's guard had to rush to the rescue, and once more the robbers fled when they found a determined foe. The next day's march also lay through dangerous country. The trail lay up a long, densely wooded valley, which provided ideal cover for brigands. This time the explorer sent the yaks ahead, with an advance guard of two rifleman, and brought up the rear with the main guard. Soon they came upon two armed Tibetans, who seemed friendly for a few minutes and then bolted into the forest.

It was an anxious march for the next few hours, stumbling along in falling snow along a trail impeded by rocks and fallen trees and in places sheets of ice, all involving laborious detours through the pine-trees, while every minute they expected to hear a burst of rifle fire from an ambush. Towards evening, however, they at last reached an open space, and felt that now they were in safe territory. A few days later they reached Kanze, and then took the well-worn trail to Tachienlu, where they arrived in the middle of February. Sir Eric Teichman had brought his mission to a glorious conclusion. He had saved his band of refugees, arranged a peace, and explored some hundreds of miles of difficult country.

11

AMONG THE HEAD-HUNTERS OF NORTH BURMA

THE CAMPAIGNS against the Japanese in Northern Burma proved to be some of the most difficult operations of the Second World War. This wild region of towering mountains and thick jungle is one of the most inaccessible corners of the earth, and in spite of all the campaigning there are still districts about which very little is known. Only a few years ago this region was notorious for its head-hunters and for tribes so primitive that they are little beyond the Stone-Age level of culture. Parts of the Naga Hills have been administered by British officials for some years, but many areas, before the War, were still ruled by native chiefs. Even now the Naga peoples who live in the administered areas dare not enter into certain villages since 'cheap' heads of unprotected travellers are only too welcome.

The gateways to the Naga country are well guarded by nature. The mountain peaks rise to 12,000 feet, and the hot valleys are clothed with tropical jungles, where roam tigers and large herds of elephants. One consequence has been that for centuries the savages in the recesses of the hills have remained untouched by outside influences. Indeed, it is quite possible that they are the survivors of one of the most ancient races in Asia; and curiously enough certain of their customs suggest a relationship with the South Sea Islanders. Like the Solomon Islander or the Papuan, the Naga tribesman wears few clothes but plenty of ornaments. For instance, those who have taken a head or killed a leopard are permitted to wear a necklet of wild boars' tusks and conch shells. Like the Papuan, the Naga believes in all kinds of evil spirits, and even before he puts on this necklet he drapes it round the neck of a dog so that any evil in the ornament may enter into the animal. Other ornamental customs reveal the bloodthirsty nature of these savages. Most Nagas wear slices of elephants' tusks above the elbows, but only those who have drawn blood may wear the gauntlets

of cowrie shells. Every Naga wears a belt and a wooden sling to support his dao, but only those who have drawn blood may wear brass rings or tinkling bells attached to the belt.

The dao is the chief weapon and the chief tool. It varies in shape from tribe to tribe—some types resemble scimitars, others halberds, some are fish-tailed, and others are like butcher's cleavers. It has a longish handle, and can be wielded either with one hand or both. Many British soldiers who fought with the Chindits, the name given to the men fighting under Major-General Wingate during the Burma campaign, can testify that the dao is invaluable for cutting a path through the jungle.

Besides daos the Nagas use spears and cross-bows made of wood, on the same principle as the medieval cross-bow of the days of Crecy. The bowstring is made of the twisted fibres of a tree, and is waterproofed by rubbing it in a special plant juice. The arrows are about a foot long, of plain bamboo sharpened at one end and 'feathered' at the other end with a flat leaf from a kind of palm. Sometimes the shafts are tipped with iron and dipped in poison.

The primitive Naga still makes fire in the Stone-Age manner. His fire-stick consists of a split stick, with a bit of stone wedged in the fork to keep it open. A thong made from a sliver of pliant bamboo is passed through the split in the fire-stick, and then pulled sharply backwards and forwards until the tinder packed into the split begins to smoulder.

Although the tribes which live near the Assam border have been visited and described, there are still many things to be found out about the tribes farther in the interior. It is therefore easy to understand the delight of Dr Furer-Haimendorf, the famous Vienna anthropologist, when he was invited to accompany Mr J. P. Mills, the Commissioner of the Naga Hills District, on a punitive expedition into the unknown country. In the summer of 1936 news of serious disorder on the fringes of his district had reached Mr Mills. Two small villages, both about six days' march from British-controlled territory, had been completely wiped out by the Naga tribe called Kalyo Kengyu. The head-hunters had taken one hundred and fifty heads, and carried off most of the children

from the district. The primary aim of the expedition was to stop these raids and to release the prisoners; but at the same time it would provide opportunities for exploration and for investigation of the culture of these mysterious savages. A strong escort was essential, of course. Two and a half platoons of the Assam Rifles were entrusted with this task, and to carry kit and rations about 360 Naga coolies were hired. These Nagas all came from the controlled area, and they carried spears, shields, and—the national weapon—the dao.

Early in November 1936 the column crossed the Chimei river, which here forms the boundary of British India, and soon came to villages never previously visited by Europeans. At Mount Helipong they entered the threshold of the Naga country. Enormous trees and an impenetrable undergrowth along the slopes of the range showed that this land had never been cultivated; but on the top of the mountain, in a very bleak spot, a small village clung to the bare rocks. The inhabitants belong to the Chang Nagas and are by way of being an outpost against the foreigners. Since they were not numerous enough to go raiding themselves, these sentinels depended on their powerful allies beyond for a share in the spoils of war. On a tall bamboo pole hung the latest acquisition—the hand of a recently killed enemy. This grim token gave point to the fact that the land of fierce head-hunters lay just ahead.

For the next few days the column crossed range after range, dropping into deep, forested valleys and then climbing thousands of feet up the other side to the Naga villages perched on the tops of the ridges. At last the danger zone was reached, and a base camp was arranged on the borders of the Kalyo Kengyu country, near a village called Chingmei. The camp was fortified by a strong palisade of sharp-pointed stakes and bamboos.

The local tribesmen were friendly and acted as scouts and guides during the rest of the patrol. They were a picturesque crowd. Above their red, conical headdress—which is covered with bear's skin and boar's tusks—quivers a plume of beautiful hornbill feathers. Around the waist they wear a blue cotton cloth embroidered with cowrie shells and broad belts decorated

with small white beads. The belt supports a wooden sheath which holds the sword-like dao, and in addition they carry long spears tufted with red goat's hair, and a heavy shield of buffalo hide. Some of the men wore horn necklaces, and were elaborately tattooed with striking geometrical patterns. Their houses too were peculiar. The roofs sloped so steeply, and had such huge gables, that in places they touched and overshadowed the space before the doors. Particularly fine were the houses where the huge log drums were kept, and where, hanging on posts, were large collections of skulls—a clear indication that Chingmei had not always been as peaceful as it seemed to be just then.

The chief of Chingmei told Mills that the villagers of Pangsha had been responsible for the raids, but that he did not know the exact position of the place. There was good reason to believe him, since the Pangsha people sent challenges through neutral tribesmen inviting the British to come and fight them. The expedition, they said, consisted of women, against whom they would not even bother to use their spears and daos. They would leave their own women to deal with the invaders, and on no account would they hand over the prisoners. Nevertheless, when it became clear that Mills intended to attack them the enemy sent, through intermediaries, three of the captives—a woman and two children. These miserable creatures had fully expected to be slaughtered at the next great feast. This tribe did not deter Mills from his chosen course, since he knew that there still remained at least one more captive; and he gave the order to advance. Most of the coolies and all unessential baggage was left behind. From now on it would be active service.

The first village they reached was unfriendly, but the column was too impressive to be attacked. In the centre of the village stood the 'head-tree' against which were leaned long bamboo poles on which were hung numerous heads. Fortunately, one of the inhabitants had a personal grievance against Pangsha, and agreed to act as guide through the unmapped region.

Mills learned that another Kalyo Kengyu village, called Noklak, lay between him and his objective. Since this village was at war with Chingmei, the way along the steep hill-side

was completely overgrown and a road had to be cut laboriously through the jungle. It was clear that danger lay ahead. The path had been thickly set with *panjis*, which are sharp bamboo spikes, intended for the bare legs of the enemy. The *panjis* were practically invisible, and before long three men had been spiked, one of the Chingmei scouts having his foot pierced right through.

Near the village a great crowd of warriors in full panoply stood waiting. After a lengthy period of shouting the warriors agreed to give way, and explained that they had planted the *panjis* for fear of offending the powerful Pangsha tribe. The village was well defended. There were sentry boxes on the tree-tops, which were reached by bamboo ladders from within the stockade, and from these vantage points the natives could see over a large expanse of land. The gateway consisted of a narrow, roofed gangway through a living palisade of prickly shrubs and intertwined creepers.

Once inside the village Dr Furer-Haimendorf noticed many striking differences in culture. The houses were roofed with slates, for instance, and the drums, or gongs, were huge in size. Many of these were hollowed-out tree-trunks, in which a man could sit with comfort, and they suggested some cultural affinity with the log-drums of Oceania. The men's houses, or *morungs*, also were very like the sort of thing one finds in New Guinea.

From Noklak it was possible to look down into a great valley winding southward through unknown country to a range of high mountains. The route for the next few miles ran along this valley, and at last Pangsha came in sight on one of the far slopes. There appeared to be two settlements about three miles apart, and the golden fields beside them gave the scene a very peaceful aspect. But Mills knew that these villages were the terror of the countryside, and had already been warned that the savages would try to lead him into an ambush by offering presents.

Sure enough it was not long before a small party began to approach, and they were leading a goat. But at the same time through the field-glasses it was possible to pick out masses of armed men crossing the river and disappearing into the jungle where the path led down the valley. The envoys were therefore

sent back, and in order to avoid the ambush the column cut a way straight down to the river and prepared a camp. Here they spent an uneasy night, as at any moment they expected a volley of the famous Pangsha cross-bow arrows. These arrows are poisoned with the juice of an unidentified tree, and the effect of the slightest scratch is to paralyse the lungs.

Morning came, and the attack had not materialized. The column moved on to the village, and to their surprise found that the inhabitants had fled. The reason was clear. Like ancient Sparta, Pangsha was so confident it would never be attacked that it was not protected by defences like a normal Naga village. The houses too were widely spread between gardens instead of being crowded together in a strategic position. Overshadowing one of the huge log-drums towered the 'head-tree' with its thick bundles of human heads, some with the skin and hair still well preserved. Mills decided that as the inhabitants had fled without handing over the captive the only thing to do was to burn down the huts, and in a few minutes the village was a blazing mass of flames.

The next day the other village was burned in like fashion, and here the Doctor took the opportunity to collect some of the skulls from the 'head-tree' for anthropological specimens. Since none of the coolies would carry the load, he had to bear the basket himself. Then the expedition set off on the homeward trail. The road led for some distance through fields of giant millet, ten feet high, and they had not gone more than a few hundred yards when the reason for the flight of the savages became only too clear. Whilst they could not defend the villages easily they could steal upon the soldiers in the fields, and wipe them out almost before they could adopt a battle formation. Suddenly a stream of armed men came pouring out of the hiding-place and, running with incredible speed (although they were carrying spears and shields), tried to cut off the column from the open country. Outnumbered by ten to one Mills quickly realized that in a hand-to-hand fight among the millet his men would stand no chance. The only hope was to find a clear space where the range would help and where the enemy could not keep out of sight until they were ready to charge.

As it happened the fight developed almost into a race. Dashing forward as fast as possible, the soldiers succeeded in getting between the enemy and the river. But the Pangsha warriors were close on their heels, and, though they could still not be seen, their war-cries grew to a deafening roar as they rushed down the slope in pursuit. Just at the vital moment the advance-guard reached a little knoll and from that vantage point they could see the threatening horde. Quickly they took aim and fired over the heads of the rear-guard. The Pangsha men faltered when they saw their leaders fall, and dropped back for a short distance. This timely check gave the rear-guard a chance to get out of danger, and, though the warriors continued to follow the column down the valley, the attack was not repeated.

Having arrived safely at Chingmei, Mr Mills sent an envoy to Pangsha telling them that he was ready to talk things over. He was justifiably confident that in spite of the rapid retreat the Pangshas would regard the loss of their warriors and the burning of the villages as a grave defeat. He was not surprised therefore when two days later a deputation arrived from the enemy, and a truce was arranged on condition that the captive was handed over. The Pangsha men, like true savages, were soon talking quite amicably about the fight, and a few days later the captive girl was brought into the camp.

The expedition then moved on into the southern parts of the Kalyo Kengyu country, and at one village the Doctor was given a fine opportunity to study native customs. The people of this village had recently lost ten heads to the Pangsha tyrants, and they therefore arranged a great dance in honour of the white men who had defeated their enemies. The ceremonies were conducted by a sort of witch-doctor, since there did not appear to be a chief. The Doctor also found that the news of the Pangsha victory had spread farther westward, and when he returned to the controlled area of the Naga District he was welcomed warmly, because it was known that he was bringing human heads. Although he had intended to use the souvenirs for a very different object, he gave way to the supplications of the natives who are now forbidden to go head-hunting. In this way only was it possible for him, a white

man, to see, for the first time, the ceremonies connected with head-hunting.

It was quite clear that the ceremonies were a kind of religious festival in which sympathetic magic and fertility rites played a big part. Each part of the head has a special magical significance, the jaws being the most important. The preparations for the feast went on for several days, and there was much beating of log-drums and much furbishing of ornaments and head-dresses. Many of the ornaments could not be worn before the head had been provided, and so the Doctor's visit was regarded as a godsend by the young warriors who desired to attain the full status of a man.

For three days there was much feasting and many processions, and nobody went out into the fields. Then life returned to normal, but the young men danced and shouted as they went to work—they had 'come of age,' and good crops were assured for the future.

THE WILD WA TRIBES

In the difficult mountain lands where Burma meets Assam and Yunnan stretches a mysterious and dangerous region which has long defied investigation. The eastern section is the home of the wild Wa tribes, and here, hidden away among the steep mountains, the fierce aboriginals still follow the ancestral custom of head-hunting. Little was known about this area except the strange stories related by border natives, and the one or two white people who had penetrated into its fringes brought back tales of long lanes of horrible skulls fringing the tracks which lead to the Wa villages. Eventually the raids of the head-hunters along the international boundary made it necessary for the Chinese and British Governments to trace a frontier through this no-man's-land, so that the savage tribes could be brought under the influence of civilized law.

A Swiss colonel of artillery, Colonel Iselin, who had specialized in frontier problems, was chosen as a neutral surveyor; and his small expedition was accompanied by a troop of Chinese infantry. In March 1937 he arrived at Meng Tung, the little Chinese town on the frontier, and at once began to realize the difficulties of his task. A year previously the town

had been pillaged and burned by the bandits of Young Rouk, and the only shelter the Governor could offer was a makeshift room amid the ruins of the official residence. Near by sprawled the calcined stones of a desecrated temple and the remains of a smiling Buddha. There were, too, the pitiful remnants of native huts which had been burned down so that the inmates might be forced out and decapitated.

The Governor told Iselin that in order to penetrate the Wa country the expedition would have to travel first through the lands of the Young Rouk bandits. He thought it possible that this might be accomplished with the forces at his command, but doubted whether he could succeed in crossing through the country of the head-hunting Was. Indeed, it seemed quite probable that the expedition would be trapped between the two regions, but Iselin was not the man to turn back. "We shall go on," he commanded.

Since the country consisted of dense jungle broken by the jagged peaks of chaotic mountains, it was only possible to advance by keeping to the native tracks linking the villages. Thus before long Iselin found himself marching into the den of the bandits. Spread out before the stockade and barring the way was a crowd of yelling natives. Interpreters were sent forward to negotiate a passage, and after a time it seemed that they might be successful. Then Iselin noticed that, while pretending to negotiate, the chief was trying to entice them into an ambush, and so the Colonel decided to take more drastic action. His escort slipped away into the jungle and encircled the village. Then, following the native custom, a volley was fired, and the assault on the palisade began. Soon one of the soldiers reached the parapet and jumped over. He was followed by another and another. Then plumes of black smoke began to rise; and the bandits started to scatter. Iselin knew that the destruction of the huts did not mean a victory—they could be rebuilt in a short time; and for the next three days the fight went on doggedly, as the enemy were driven back along the trail. At length the bandits made their submission, and brought the traditional offerings of a bull and some sugar-cane.

The march went on. The line was now much longer,

because the wounded soldiers had to be carried in litters, and the danger of ambush was increased as they were right in the midst of the Wa country. Camp was pitched on the river Dung Ding, and the sentries were doubled. Iselin, his assistant, and the Chinese commissioner had just sat down to a meal of barking-deer when the servant entered the tent with the news that two native chiefs wished to see the leader.

"Show them in," said the Colonel. The two men came into the tent, their hands folded on their foreheads and bowing in submission. Then, drawing himself erect, the older of the two fished into his haversack, and placed on the table an object which made the three officers jump up with surprise and disgust. It was the finest present a Wa chief can possibly offer to a distinguished visitor: a freshly severed human head!

"Throw it out!" roared the Colonel, and then added "And clear the table." None of them had any appetite left. The two chiefs, highly puzzled, could not understand the commotion, and it needed all the persuasion of the interpreters to make them believe that their present was unwelcome. A few minutes later, however, they timidly raised the door-flap of the tent again, and, with a gesture which obviously meant "Well, at least accept these," they proffered a pair of ears on a bamboo spit. The reaction was violent this time, but it was equally misunderstood; and when Iselin went out of the tent he found the ears carefully placed outside the door.

There could be no doubt that the Wa chiefs meant to be friendly; and it transpired that since the expedition had been the enemies of Young Rouk, who was an enemy of the Was, then therefore the white men must be allies. It thus arose that the expedition were able to witness the mystery of the 'Feast of heads' and to photograph one of the alleys of skulls. One of the chiefs explained that the feasts of heads were in honour of the gods Ha Mah and Ni Mah, who lived in a sacred lake surrounded by ten mountains. Apparently long, long ago the chief god of all had been pleased when Ha Mah had taken a human head to play with, and had in consequence granted a son to him. Thus head-hunting had become the symbol of fertility. Every eleventh day of the third moon a great feast

is celebrated, during which prayers are said to the heads so that the paddy fields shall be fertile.

During the next few days the head-hunters began to return for the festival, which was about due. The number of their trophies was considerable, as they had taken advantage of the defeat of Young Rouk to attack him unexpectedly. They had even disinterred the dead in their ghoulish hunting. The village was stirred up into transports of joy, and while the men told of their exploits the women prostrated themselves before the heads and offered refreshing drinks to the warriors. Then a great booming of gongs announced the great news.

On the day of the feast the skulls were arranged in bamboo receptacles, and the whole village went out to review them. With every expression of joy, because of the increased fertility thus ensured, the natives feasted on cooked meats and rice liquors. Then followed an incantation to the heads, and a symbolic feeding of the dead. Later on the grim souvenirs would be carried off in a procession to the sacred alley of skulls in the jungle.

The head is placed in a hollow trunk, which is pierced with a little window through which the spirit can look out over the village and protect it from enemies. The head of a chief is particularly effective, and the head of a stranger race the most valuable of all. Iselin realized that the price on his own head must have been colossal, and as it happened had to fight hard to keep it on his shoulders during the next few stages of his mission. At the next three villages there was serious fighting. They had to take by assault these strongholds, which were defended by a *cheval de frise* of poisoned bamboo, then a trench which led to a tortuous tunnel closed by massive doors. Iselin saw one of his little soldiers shot with a poisoned arrow, which killed him in ten seconds, and there were several other casualties. But in the end the expedition won through; and much geographical and anthropological information was garnered.

Meanwhile a British survey party under V. C. Pitchford had entered the Wa country, and their route led them into the unexplored region about Lake Nawngkhio—the sacred lake of

the Wa tribes. Pitchford found that the first tribesmen he met were friendly. Probably they were impressed by the escort of a hundred Gurkhas and Chinese. Nevertheless, before long fierce tribesmen began to threaten to fire on the column if they did not retreat. Fortunately, the surveyor was able to impress the chief by inviting them into camp and allowing them to listen in to a broadcast from Hong Kong.

At last they arrived among the Toila Wa, who claim to be one of the guardian tribes of the sacred lake. As the column wound along the track to the village a large crowd of natives barred the way, and began to howl defiance. Gradually the excited throng retreated to the tunnel entrance to the village, and a moment later the way would have been barricaded. Pitchford then called a halt, and by means of interpreters did all he could to persuade the Toila people that he intended no harm. Eventually the village elders came forward, and after much argument agreed to communicate with the other guardian tribes so that the expedition could visit the lake.

Early next morning Pitchford set off with an escort of five rifle sections and a Lewis-gun section. There were five guides, all of whom said that three of the villages on their way might decide to bar the way to the holy of holies. Moreover, after marching a short way the guides declared that it was too dangerous for them to continue, but that if the explorers would continue marching in a vaguely indicated direction they would find the lake for themselves. Half an hour's delay and a good meal sufficed to make them change their minds, and they went on for another two or three miles. Then they stopped again, and refused to go on into the danger zone until they had been provided with some disguise. The necessary camouflage was devised out of blue flannel blazers and khaki tunics, and the march continued.

A little later two women and a man with a gun suddenly dashed away from some cultivated patches to spread the alarm, and the guides promptly changed direction and plunged across country through thick jungle. For the next hour the column ploughed through thick undergrowth, and at last came out on a poppy-cultivated hill-side where there were many felled trees of huge size. The way now led past two high

conical peaks, and soon they reached a rocky track through dense forest, which brought them to the eastern end of the lake.

Rapidly the survey section mapped out the district. The lake was by no means as large or as impressive as they had imagined, and they could only see three mountains instead of the legendary ten. It was now late in the afternoon, and Pitchford realized that the homeward journey through the jungle might be very awkward. But the guides this time led him to a track worn with the feet of hundreds of pilgrims. It was precariously steep and rocky in places, but it avoided the undergrowth, and the sturdy Gurkhas made rapid progress. On the way several small parties of Was were passed, but these were evidently friendly tribes, and no opposition was offered. This was doubly fortunate, since by the time the column got back to camp it was pitch dark.

At the next village the men were less friendly, and stood defiantly beside their skull groves as the column approached. Once again a display of tact preserved the peace, and the expedition passed on through other villages and groves until they had traversed the whole of the unknown area.

12

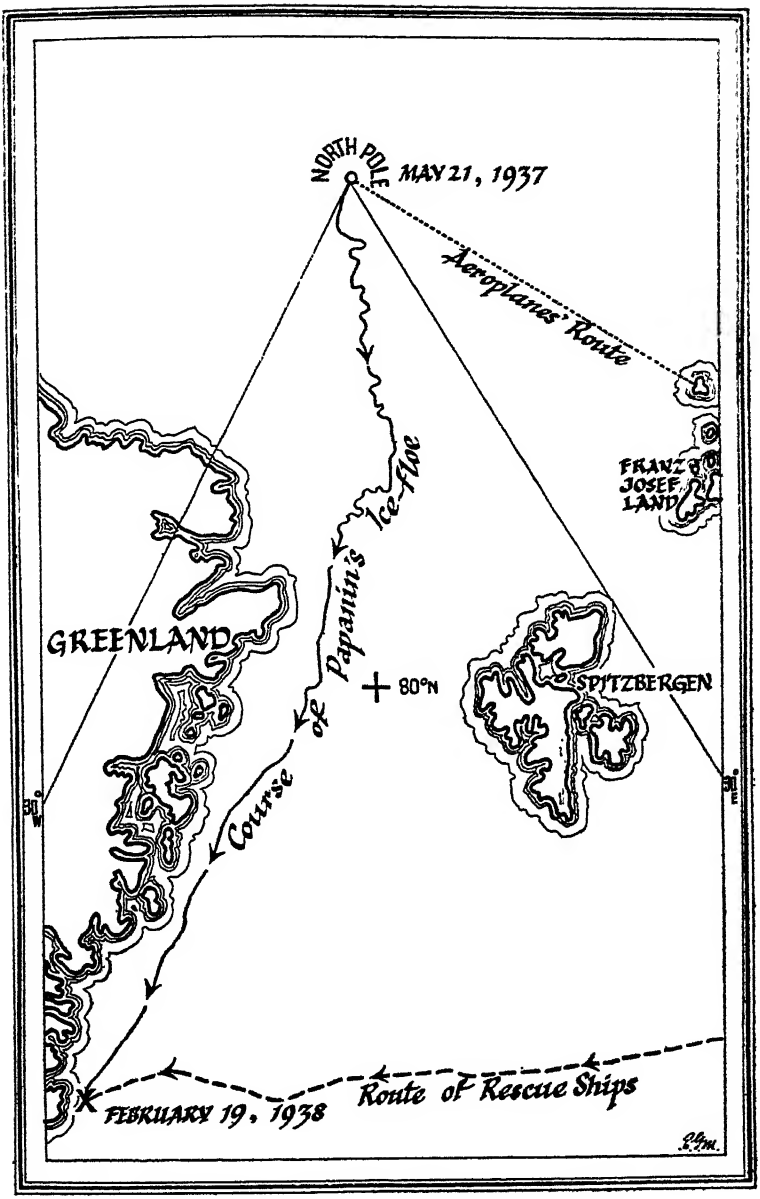
THE SOVIET EXPEDITION TO THE NORTH POLE

NORTH POLE, June 29*th*. A savage north wind has been raging for more than twenty-four hours. Our tent is trembling under its blasts. Rain has been pouring down for hours. . . . Under our feet is snowy slush.

When Peary first reached the North Pole in 1909 he little thought that the daily weather bureaux would be able to record such climatic observations from that most inaccessible of all places. He would have been even more surprised if one could have told him that a party of men could establish themselves on a drifting floe and live in comparative comfort for nine months at a stretch. Science marches on. Not only have these miracles come about, but it is possible to envisage the time when a permanent observation post may be set up in the vicinity of the Pole, so that the Trans-Polar Air Express may land there and collect the latest information about the conditions over the Arctic Ocean.

It is fitting that it should have been a Russian expedition which first established a base at the Pole, since the Soviet has been foremost in the recent exploration of the Arctic Ocean and the navigation of the dreaded North-east Passage. In 1933, for example, a large party of Russians were shipwrecked when the *Chelyuskin* was crushed in the ice, but the whole company was saved by the heroic efforts of Russian airmen. Again in 1936 a string of cargo-boats convoyed by ice-breakers made the whole passage of the Arctic Ocean from east to west, and so inaugurated a new trade route.

Moreover, the rapid development of aviation has drawn attention to the possibility of flying along a great-circle route across the Pole to America. "We are going to the Pole, not as passing visitors, but as colonists," declared one of the members of the expedition. The idea was that a station at the Pole could act as a half-way stage and as a weather bureau for the proposed air-route between Moscow and San Francisco.



THE SOVIET EXPEDITION TO THE NORTH POLE

That this was a feasible proposition was shown only a month after the station had been established, when Chkalov piloted a plane from Moscow to America. A second Soviet plane followed the same route, and beat the previous non-stop record by flying to Southern California.

The idea was conceived by Professor Schmidt during the eight weeks he spent on the ice-floe after the wreck of the *Chelyuskin*. When he began to work out the details he did not have to look far to find a leader. Ivan Papanin, after serving as a soldier during the civil wars, had had much experience in the Arctic. He had assisted in the exploration of the whole Franz Josef archipelago, and on one occasion had a narrow escape from death. He and a companion had set up a tent on one island, and began to cook their dinner. The strong wind carried the appetizing smell for miles, and a hungry bear came to investigate. When the brute arrived the men were inside the tent, and the watchdog, startled by the sudden stealthy approach of the bear, yelped in terror and raced off for the sea. The yelp awoke Papanin, who immediately thought of the rifles that had been left outside near the sledges because they feared that moisture would form on them inside the tent. Papanin looked out, almost collided with the bear, and quickly dodged back. The bear began to march round and round the tent. Papanin found a revolver and fired it, hoping that this would startle the beast and so give him a chance to grab a rifle. But the bear took no notice. Then suddenly the two men shouted in unison, and this had the effect of making the bear jump back just far enough to enable Papanin to reach a rifle and shoot the offender.

Papanin had been director of several Arctic weather stations since, including that at Cape Chelyuskin—the most northerly point of Russia. His capabilities as an organizer and his keen interest in polar exploration made him an obvious choice for leader. Papanin took with him as companions Krenkel (wireless operator), Shirshov (marine biologist), and Feodorov (magnetologist). Incidentally, Shirshov was to act as emergency doctor, and with that end in view spent a whole hectic year attending hospitals in Leningrad. The others equipped themselves as efficiently as possible, so that

a very wide range of scientific observations could be carried out.

In August 1936 a base was set up at Rudolph Land, the most northerly point of the Franz Josef group and only six hundred miles from the Pole. Here there are a number of flat places on the ice-cap which would serve as aerodromes for the squadron of planes. Altogether seven machines were used, although the main work was done by four huge four-engined aeroplanes. Into these Papanin stuffed as much food and equipment as he could manage, until in the end the pilots had to protest. Papanin even wanted to stow away a large live pig!

The flight to Rudolph Land was no pleasure trip. For several days the squadron was delayed by blizzards at an intermediate station in Novaya Zemlya. One day the wind blew so hard that they feared the machines might be smashed. Even to reach the planes was no easy matter, since it was easy to lose direction in the howling blizzard. However, they reached the planes and moored them with ice-anchors. That is, they dug pits into the ice and then buried logs to which mooring cables were attached. These anchors held the machines well, and the only damage suffered was a broken rudder.

On April 18, 1937, the expedition reached Rudolph Land, and found a hearty welcome from the occupants at the station. They had rigged up a polar bear which was frozen stiff and which held in its paws a salver and a heavy iron chain with a substantial ' Key to the Pole ' at the end of it.

Many days were spent in collecting and storing the loads of provisions and instruments. On May 5 it was decided to send out one of the planes to see what conditions were like around the Pole. If conditions were good then a wireless message would be sent, and the whole expedition was to proceed. Golovin, the pilot, flew on and on, until at the eighty-eighth parallel he struck a wall of cloud. Soon his machine was flying over an unbroken sea of clouds. When they were sixty miles from the Pole Golovin was handed a note from the observer to say that only half the petrol was left, but he decided to fly on, and soon after Schmidt received the laconic message: "Latitude 90. Pole under us, but covered thick layer cloud. Failed pierce through. Laid return course. Golovin."

Thus was announced the first triumph of the expedition. Although Golovin reached Rudolph Land on the return journey with only the dregs of his petrol left, the Pole had been reached!

On May 11 another plane, piloted by Kruze, went off on a reconnaissance flight. The expedition flew past the eighty-fifth parallel and then turned back because the clouds were so thick. For an hour or more Kruze flew above the clouds, and, since he could find no break, finally turned the nose of the machine downward. Down the plane dropped through an evil-smelling fog, until the altimeter showed only 300 feet, but still not a thing was to be seen. Suddenly a black spot like a craggy cliff gleamed under the port wing, and Kruze soared upward again into sunlight. By this time he had no idea where Rudolph Island was, and he only had enough petrol left for forty minutes' flying. Yet again he dived into the cloud, and at once a thin film of ice began to form. The fog belched below until the plane had dropped to ninety feet, and then Kruze found that he was flying over freshly formed ice criss-crossed with dangerous cracks. At last he saw a floe which he thought big enough to land on. The plane touched the surface, made a gigantic leap off an icy block, and came to rest.

The crew at once began to unload their emergency rations, and put up a tent. Then wireless communication was established with the base. For two days the weather was so bad that it was impossible to send help, and even then Golovin, who had set out, had to turn back because a blizzard reduced visibility to 600 feet. The nights were bitterly cold, and on two occasions they were visited by polar bears. Eventually, on the fifth day, Golovin flew overhead, and dropped three parachutes with petrol and stores; and two days later, just when their floe was threatening to break up, they managed to clear a run-way and fly back to the base.

The bad weather still held up the main flight until May 21, when at last one machine set off carrying Papanin, Schmidt, and eleven others. The plane kept in wireless communication with the camp until the Pole was almost reached. Then suddenly there came a long silence. Ten hours passed in terrible suspense. It was impossible to send out a search plane, because Rudolph Land was shrouded in fog. Then suddenly

the whole station was aroused by a shriek from the wireless operator.

"They have landed!"

Actually the flight had not been without its anxiety for the leaders. About an hour after setting off one of the mechanics had noticed a stream of vapour rising from the centre port engine. He thought at first it was the exhaust, but careful examination showed that there was a leak in the cooling system and the special anti-freeze solution was disappearing. If the supply ran out that engine would certainly stop.

"Can you manage a repair?" asked Schmidt.

"Only if we land first," replied the mechanic.

The chief pilot was startled by the report, but decided to fly on, even if it meant flying with only three engines working. However, two of the mechanics found a solution to the problem. They first located the leak, and tried to stop it with tape. But the fluid still came through, so they applied damp cloths which absorbed the leakage. Then they squeezed the cloth into a pail, and from the pail pumped it back into the radiator. In this way not much fluid was lost, and the engine continued running smoothly. The mechanics continued this irksome task until the Pole was reached, although their bare hands were frozen and chapped until the blood flowed.

During the flight the wireless generator had burned out, so that it was some time before they were able to announce their safe arrival: "After establishment of radio transformer on new Polar station. Ice-floe on which we are stationed lies about 20 kilometres beyond Pole . . . quite suitable for scientific station. Possible make fine aerodrome here to take other planes with station cargo."

In the next twenty-four hours five tents sprang up on the ice-floe, and already weather reports were being issued. They were already studying the drift of the floe and were preparing for the coming of the main party. The three other planes set off from Rudolph Land on May 25. Two arrived safely, but the third, under Mazuruk, got out of line, and for two days the Polar station heard no news of him. Then news arrived via the wireless station at Cape Chelyuskin that Mazuruk had landed safely. Soon direct contact was established and bear-

ings sent out, so that the lost pilot could determine his position relative to the camp. Mazuruk had landed on a very uneven floe, and for some days he and his crew were busy breaking down ice mounds so that a level field could be arranged. At last, after the Polar station had been established for eleven days, Mazuruk was able to take off, and soon came humming over the camp to make a perfect landing.

At last the Polar station was fully equipped, and the planes were prepared for the return journey. Since there was not enough petrol left for all the fleet to complete the flight, it was necessary to arrange for one of the planes to land on an ice-floe and to be refuelled from the base. This was eventually accomplished; and the squadron then set off south for Moscow knowing that a great reception was being prepared for them.

From the moment when Papanin had established the camp at the Pole he was aware that the floe was drifting towards the south. During the first fortnight they travelled sixty-eight miles, and the end of a month found them about twice that distance from the Pole. Six months brought them near to the north-east point of Greenland; and by February 19, when the party was rescued, they had drifted down the east coast of Greenland to the same latitude as the North Cape of Norway. Thus altogether their icy craft had travelled not less than 1300 miles in 274 days. Actually the distance travelled was probably a good deal greater, because the floe did not follow a straight line and the effect of the winds was to cause considerable irregularities. The speed of drift also varied. In the Arctic basin the average rate was about three miles a day, but farther south the average was thirteen miles each day and when the north wind blew strongly they once travelled 34 miles in the twenty-four hours.

Life must have been terribly monotonous for the little band. For almost nine months the only view was one unending vista of ice and snow. Yet there was plenty to do, and little time to get depressed. The camp was very well equipped; and each man had definite duties to perform. A large tent protected against the wind by a wall of snow served them for a dormitory and a workshop.

Encircling the main tent was a kitchen with four cookers, a

meteorological and magnetic observatory, a science laboratory, and wireless installations in little tents. In the autumn the wireless was placed in tiny igloos, and the necessary electricity was provided by a windmill. When there was no wind the men had to provide the power by pedalling a dynamo. Four times each day weather reports were transmitted direct to Moscow for publication in weather maps all over the world. From time to time they measured the depth and temperature of the water, and made some important discoveries. They found, for instance, that there were definite traces of the Gulf Stream quite near to the North Pole, and that at depths between 900 and 1500 feet there was a great layer of comparatively warm water.

This particular sort of work was very exhausting. A heavy lead was lowered through a hole in the ice, and at varying intervals on the cable thermometers were attached. Then at the appropriate moment 'messengers' were sent hurtling down the line to turn the instruments over and close them so that samples of water and the temperature could be taken. Then came the long job of hauling up the cable. It took two men six hours to wind the cable in with a winch. Once the depth recorded was over two and a half miles.

Although it may seem paradoxical, during the first three months of the drift the Russians were more troubled by the heat than by the cold. On June 2, for example, the thermometer rose above freezing-point by two or three degrees, and there was a complete surface thaw. The men even launched their skin canoes on the ponds which formed.

Later on when the long Polar night fell it became increasingly cold, although the thermometer never fell to Siberian depth. The month of January proved to be the worst. A series of storms upset the regular routine, and at the same time it became bitterly cold. The wintry blasts began to break up the ice-field, and before long that section with the sounding apparatus on it broke adrift. Soon there were lanes of water showing all the way round the camp, and the sleeping-tent was only three hundred yards from the edge of one of these 'leads.' The position became really grave. On the evening of February 1 Papanin and Krenkel were playing

chess when there was a sinister crackling behind them. Since they were used to the groans of the moving floe they took little notice. The noise grew louder, but they went to bed without any unusual anxiety. However, in the middle of the night a sudden crash awoke the camp: a crevasse had opened up not six yards away from the tent, and it looked as if the food depot would be swallowed up any moment. As quickly as they could, by the light of a lantern, they went to the rescue, and saved their provisions.

The next morning they discovered that the floe was now only about five hundred yards long, and a catastrophe seemed imminent, because crevasses were opening up all around them and the floe was threatening to split up into dozens of tiny bergs. Papanin and his three companions finally took refuge on a floe which was about fifty yards by seventy. This threat of disaster, however, did not stop the gallant party from continuing their researches and sending regular bulletins to Moscow. They were buoyed up by the news that ships had already been sent to rescue them. The little floe was always rocking, and they had to be ready to change station at any moment. On February 3 the sun reappeared, and a few days later, as if to celebrate the return of daylight, there came a period of calms. The icebergs began to knit together, and the open channels froze over. On the same happy day the explorers got their first glimpse of land—the mountains of Northern Greenland.

Meanwhile the European Press had been alarmed at the possibility that the brave adventure might have a disastrous end. The station had already drifted so far south that unless relief soon arrived there would be considerable danger. The first ice-breaker sent out from Murmansk had not been able to make much headway; and the *Taimyr* and the *Mourmane* seemed to be having a hard fight with the pack-ice. On February 13 the two ships had reached within a few miles of the camp, but they were now held up by a thick bank of old, hard ice. Since further progress by sea was impossible, the aeroplanes on board were prepared; but now a strong south-west gale sprang up. The ice-field began to groan and crack, and the plane had to be hastily reshipped. Still there was one

consolation, for the gale opened up new leads and the *Taimyr* was able to advance another seven miles. The next day the wind dropped, and an aeroplane set off for the camp. But a snowstorm impeded visibility, and so the camp was not located, and the plane had to take refuge with the *Mourmane.*

On the following day, however, a second effort was successful, and for the first time in nine months Papanin and his brave companions were able to talk with strangers. On February 17 the ships were able to approach to within half a mile, and there they were moored. Before another day had passed Papanin and his men and all the equipment of the station had been taken aboard, and a course had been set for home, where a triumphal reception had already been arranged.

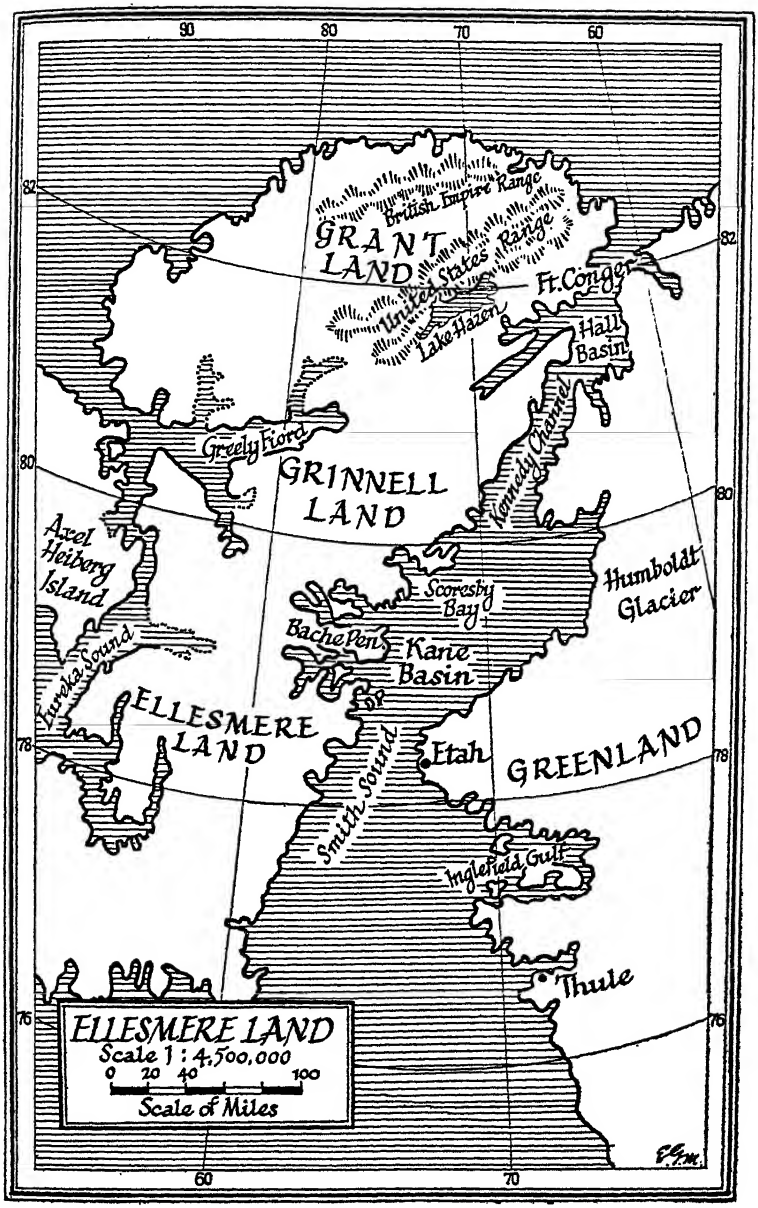
13

EXPLORING UNKNOWN ELLESMERE LAND

ONE OF the most remarkable features of recent exploration has been the enterprise of young men fresh from their studies at the universities. Some of them, like Gino Watkins, have gained undying fame while still in their early twenties, and others have made very valuable additions to our knowledge of the unknown parts of the globe. The Oxford University Exploration Club, for example, has to its credit six expeditions to the Arctic regions, besides tropical journeys to British Guiana, Borneo, Abyssinia, and the New Hebrides. The expeditions have not been purely geographical, and a great deal of botanical, biological, and geological information has been collected.

In 1934 it was decided to send a small expedition to Ellesmere Land, or Grant Land—that large island, 500 miles long, which lies off the north-west coast of Greenland. Although Ellesmere Land was first discovered as long ago as 1616 by Baffin, and although numerous explorers have landed on its shores, very little was known of the country behind the coastline. In 1881 General Greely had established a base at Fort Conger, and had found the lofty United States Range of mountains and a large lake called Lake Hazen, but the expedition so successfully begun ended in tragedy. Relief expeditions found it impossible to reach Greely, and it was not until 1884, when seventeen of the twenty-three men had died of starvation, that the survivors were rescued.

Dr Noel Humphreys, who was appointed leader of the 1934 journey, hoped to establish a base at Fort Conger in Northern Grant Land, and from there reach the unknown country beyond the United States Range. The party comprised six men, and included Edward Shackleton, son of a famous father, Sergeant Stallworthy, of the Canadian Mounted Police, Haig-Thomas, a Cambridge rowing Blue, A. Moore, who had been on the Borneo expedition, and twenty-year-old Robert


90
80
70
60
82
80
78
76
60
70
GRANT LAND
British Empire Range
United States Range
Lake Hazen
Ft. Conger
Hall Basin
Kennedy Channel
Greely Fiord
GRINNELL LAND
Axel Heiberg Island
Eureka Sound
Scoresby Bay
Humboldt Glacier
Bache Pen.
Karie Basin
ELLESMERE LAND
Etah
GREENLAND
Smith Sound
Inglefield Gulf
Thule
ELLESMERE LAND
Scale 1 : 4,500,000
0 20 40 100
Scale of Miles
E.G.M.

Bentham, of Nottingham University. Since Dr Humphreys is a graduate of Cambridge the expedition might fairly claim to be representative of all the English Universities. Stallworthy was already a veteran of the Arctic, and had been in charge of a police post at Bache Peninsula in Ellesmere Land. His knowledge of Arctic life was to prove invaluable.

The Norwegian ship *Signalhorn* set sail from London on July 17, 1934, and by August 5 the great ice-cap of Greenland glittered on the starboard side. At Jakobshavn supplies of Arctic equipment were obtained from the Greenlanders, and arrangements made for dog teams and the employment of Eskimo assistants. At Thule two Eskimos and their wives, who were to make the sealskin boots and deerskin clothing, were picked up, and the *Signalhorn* butted her way northward through loose pack-ice, bound for Fort Conger. However, soon after the far-off mountains of Ellesmere Land had been sighted a great ice-barrier was seen from the crow's nest, and it quickly became clear that the ship could not penetrate far into Smith Sound. While awaiting better conditions the party hunted walrus, and had soon garnered several tons of meat for their ferocious huskies.

On the seventeenth the ship made another effort, but after following a long lead for some miles a solid wall of ice twenty feet thick was encountered. Reluctantly, they had to turn back, and finally decided to set up their winter quarters at the deserted settlement of Etah, on the Greenland coast, and nearly three hundred miles south of the proposed base at Fort Conger. A strong hut was built, and a number of short depot-laying and hunting trips were undertaken before the long Arctic night closed down and suspended activities. The dogs had been brought ashore from the little island on which they had been landed, and the young explorers began to learn the difficult art of driving dog teams. When the day's duty had ended they would listen in to the wireless, read books, or play cards, and plan the trips which were to be undertaken in the Spring. Some of them took the trouble to learn some words of Eskimo, and paid frequent visits to the igloos of their hunters, marvelling at the skill of the Eskimo women making clothes of sealskins or furs.

On February 17, 1935, the first rays of the returning sun touched the hills behind the camp. The temperatures were still very low, however, and during some blizzards 70 degrees of frost were recorded. Dr Humphreys made a successful trip to Thule by sledge a few days later, and returned with several Eskimos, who were to act as supporting parties for the journeys across Smith Sound into Ellesmere Land. A month later depot-laying trips began to the edge of the pack at Cairn Point, each sledge carrying seven or eight hundred pounds of pemmican and supplies. By April 2 everything was ready, and, since by this time it was clear that the sea-ice was so rough that a long and well-manned trip would probably lead to starvation, it was decided that the expedition should be divided into three units—one of which was to explore Grinnell Land, another the Scoresby Bay area of Ellesmere Land, and the third was to travel up the coast of Greenland and attempt their main objective—the unexplored portions of Grant Land. Altogether ten Eskimos with their dog teams were to accompany the explorers.

Dr Humphreys with the Grinnell Land party almost met with disaster before even embarking on the sea-ice. As the party was driving down a steep snow slope the dogs got out of control, and headed straight for a fearful precipice. The men had to throw themselves off and leave the sledge to its fate, but just at the last moment the dogs swerved, and the sledge came to rest within a foot of the brink. Once the ice-foot had been reached great care had to be exercised, since in places open water extended to within a few feet of the cliffs, and a slip on the boulder-strewn ice would have meant a fall into the sea below. At one place the ice-promenade was blocked by a huge ridge of ice, and the Eskimos spent some hours here chopping until a practicable route was made. North of the depot at Cairn Point they took to the sea-ice, and, by following leads of smooth ice through the hummocks, safely reached Ellesmere Land. Next day they pushed on to the abandoned police hut at Bache Peninsula, and gave the dogs a good feed of seal meat, for near by there were patches of open water where seals were numerous.

From this advanced base Humphreys hoped to cross the

Grinnell Land ice-cap. He made for a valley filled with deep snow, where the drifts were soon thigh deep, and the sledges could get no farther. After plodding until midnight to the head of the valley they decided that the route would not be practicable. The next day the party drove up a glacier into unknown country, and were able to get a view into the interior. Although there were some mountains to the north, the rest of the country was covered by an immense ice-cap stretching to the horizon. An effort was made to reach the new range, but the snow got deeper and deeper, and it was very difficult to start the sledges again when they had stopped. Camp was pitched in thigh-deep snow; and after further efforts on the next day it was decided to seek another route across the island.

After a rest at the police hut a new trail was broken to the head of Flagler Fiord. Here the ice was wind-swept, and the dogs kept slipping over, while the sledge was often blown broadside on by the strong wind. Once on the land a convenient valley was found, and, although one of the sledges was broken, the rest of the journey across was easy. The next day they followed the western coast of Ellesmere Land, and saw herds of caribou and musk-oxen. They also found a seam of coal two yards wide—clear evidence that like the Antarctic continent the North Polar region was once much warmer than it is to-day. Early next morning the tracks of a polar bear were seen, and after a long hunt the Eskimos returned to camp in triumph, with welcome meat for men and dogs and a valuable bear-skin. This bit of luck gave them courage to plunge southward into the unknown interior, and, following a valley with overhanging cliffs, they made good progress down a plain to the head of a long fiord on the south-west coast. Humphreys was anxious to go still farther south, but the natives were unwilling, since, they said, a heavy fall of snow might make the return trip impossible. There was nothing for it but to return to Bache Peninsula, and thence after a few days' rest across the sea-ice back to Etah. All told, they had travelled a thousand miles, and were proud to have completed the first crossing of Ellesmere Land.

The Scoresby Bay party also crossed to Bache Peninsula and then marched northward across the sea-ice along the coast

towards the unexplored region. Rough ice and big pressure ridges interfered with progress, and they stripped off most of their heavy clothes as they heaved and battled their way over ice-pinnacles and hostile floes. Eventually they reached an impenetrable barrier, and had to force their way to the mainland, where after much pounding and jarring they gained a smooth ice-foot.[1] Just south of Scoresby Bay this good going gave place to a jumbled chaos of ice-boulders, and the bad ice and absence of game made them decide to abandon any effort to reach farther north.

During the night there was a blizzard; and a mighty crash brought them scurrying out of the tent. They discovered that a huge section of ice, weighing thousands of tons, had crashed on the floe on which they had camped, and that the floe was now cracked in all directions. Next day, however, they managed to penetrate into Scoresby Bay, and were able to make an accurate map of the district. They discovered that the bay was fringed by the dazzling range of the Victoria and Albert Mountains which had previously been thought to rise twenty miles away in the interior. About this time Shackleton fell ill with a kind of poisoning, and as the Eskimos could find no game they had to beat a retreat to Bache Peninsula.

Meanwhile Stallworthy and Moore had proceeded on the main expedition—to the interior of Grant Land. They were accompanied by four Eskimos, each with a dog team, and made their way steadily northward along the Greenland coast. Just before taking to the sea-ice across Kane Basin they met two Eskimos returning from a hunting expedition for polar bear. The natives had not been successful; they had no food for themselves, and they had been obliged to kill nearly half their dog teams to feed to the rest. One man was lame, and the other badly frost-bitten. The explorers gave the hunters a good feed, and afterwards learnt that they reached their settlement safely.

The next sixty miles they marched parallel to the face of the Humboldt Glacier, which presents a sheer wall to the sea, something like the Antarctic Ross Barrier. The Eskimos proved their skill in choosing the best route through the floes.

[1] A shelf of ice resting on the sea but attached to the mainland.

One of them would go ahead with the glasses and climb an iceberg to spy out the best route. Once, also, they killed four seals and a polar bear, so that the dogs were well fed. This was not before time, since some of the dogs' ribs were already beginning to show.

In Kennedy Channel two of the supporting Eskimos returned and a small depot was made for the return of the expedition. Progress through hummocks of pressure ice was slow now, and once they were blizzard-bound for a couple of days. Before leaving this camp they had to spend some time mending the broken handles and runners of their sledges. Then came the passage across to Grant Land, which was accomplished in a snowstorm which reduced visibility to a few yards. The march to Fort Conger took them through waist-deep, granulated snow, which was very bad for the dogs' feet. Peary's huts at the post were located, and, with the aid of a stove and some coal, they were able to dry out their clothes and sleeping-bags. They also found a small store of ancient provisions, and when they set off again the next day they were puffing mouldy cigars, which the Eskimos considered a great find. They were now bound for Lake Hazen, where they hoped to find large quantities of fish.

After two days of hard going over bare rocky patches and loose snow they came in sight of the United States Range, and the next morning reached the east end of Lake Hazen. Within a few minutes of their arrival they had bored holes through the ice, and were pulling out quantities of small char. They had hoped to catch some really big fish, but as it was they found they would have to spend twenty-four hours a day fishing to procure normal meals for the famished dogs. After five days of fishing it was agreed that it was hopeless for the whole party to continue, and therefore Moore and one Eskimo were to make a dash into the interior while Stallworthy and the other Eskimo stayed behind and fished.

Moore took with him the minimum of equipment and enough pemmican to give his seventeen dogs eight feeds. He broke the trail through the deep snow, and they climbed steadily along a valley to the Gilman Glacier, which sweeps down from the United States Range. The glacier foot looked like a sheer wall,

but in the end they found a way round the extreme western edge. Once on the glacier the going improved.

That night they camped at three thousand feet, building a rough shelter of snow blocks. On the top of the pass they could see to the north a high, isolated peak, and they made for this across steep ridges of hard snow until at last the razor-like edge of the summit was reached. From the top (9000 feet) of the mountain, which was named Mount Oxford, they looked northward into unknown Grant Land. Beyond them stretched a great range of mountains whose summits reached a height of 10,000 feet or more, and on both flanks also there were ranges stretching as far as the eye could see. The new range was given the name British Empire Range, but since they had only enough food left for one more outward journey they had no hope of setting foot there. Moore took photographs and made a sketch-map of the mountainous country, and, with the aid of glasses, saw the distant Challenger Range and the shores of the Polar sea on the north coast.

The return journey passed quickly; and on the way down the glacier Nookapingwa, the Eskimo, managed to shoot three caribou. When the dogs smelt the fresh meat they went nearly crazy, and made short work of their first decent meal for many days. At Lake Hazen the party found Stallworthy still fishing, but his supplies were running low, and he was glad of the fresh caribou meat.

On May 7 the homeward trek began. By this time some of the dogs were in such bad shape that they were just staggering along before Fort Conger was reached. Everything edible left at the post was scraped together, and even sealskin boots and dog harness were cut up so that the dogs could be given a meal. One sledge was abandoned, and the dash across the sea-ice to the sealing-grounds began. Progress was very slow, and even along the Greenland coast they found no seals. The small depot left there brought some relief, and on they pushed down Kennedy Channel.

By this time the situation was becoming serious, and they began to wonder if they would have to kill off some of the dogs. Suddenly a large patch of open water was seen, and a camp was made so that seals could be caught. They waited

anxiously for some time, and then a large, bearded seal came to the surface with a splash. Instantly the whole party fired at the prospective meal, and there was a frantic scramble to save it from sinking. Fortunately, the seal floated, and an Eskimo, climbing gingerly across the thin sea-ice, pulled the beast on to a floating ice-pan. In a few minutes the dogs were eating the biggest meal of their lives as their share of the six hundred pounds of meat and blubber.

For the next few days the dogs pulled very well past the Humboldt Glacier, although a blizzard held them up for a day. But seals were plentiful now, and the well-fed dogs strained at their traces when the march was resumed, so the men were able to ride on the sledges. Everything went well until they were within a few miles of the base at Etah, and then they ran into a terrific blizzard—the worst they had met during the whole 900-miles trip. They pushed on, nevertheless, and after a narrow escape from a crashing boulder drove into Etah to find all their friends safely home again after their successful expeditions to Ellesmere Land and Scoresby Bay.

14

THE THULE EXPEDITIONS

THE ROMANS called the most northerly regions of the world Ultima Thule. It was these regions which were explored by one of the foremost of modern explorers, Knud Rasmussen. He had established a base at a place he called Thule on the north-west coast of Greenland, and from there he directed no less than seven Arctic expeditions—the first in 1910 and the last, which ended with his death, on December 21, 1933.

On both sides Rasmussen was partly of Eskimo blood, and he was born at Jakobshavn, in North Greenland. His father was a Danish missionary, and lived in an ancient wooden vicarage; and Knud's childhood playmates were the Eskimo children in the "Ice Mountain Town" as they called it. Consequently, Knud learned the Eskimo language before he could speak Danish. He grew up surrounded by Greenland scenery and legends, and long before he was sent to the University of Copenhagen he determined to seek out the Polar Eskimos in the north of Greenland.

At the age of twenty-three he fulfilled his early ambition, and a few years later he established his station at Thule with Peter Freuchen. Then followed a series of expeditions, in which Rasmussen not only collected geographical information but also a wealth of detail about Eskimo life and folk-lore. His first expedition established finally the non-existence of Peary Channel, and mapped out the land connecting Greenland and Peary Land. The second Thule expedition mapped the most northerly coasts of Greenland, the third was spent in laying out depots for Roald Amundsen, the fourth, sixth, and seventh were spent in East Greenland, while the fifth (1921–24)—which was probably his greatest—was a great journey along the whole Arctic coast of North America, and resulted in the mapping of large areas in Baffin Land, the Melville Peninsula, and Southampton Island.

This expedition left Thule in September 1921, and winter

quarters were established on an unknown island to the north of Southampton Island. In October, when the ground was covered with snow, Rasmussen set off to meet the first Eskimos of the American continent—the "men from behind the Great Sea," as the Greenlanders called them. Not far from the base Rasmussen heard a shot, and with the aid of his glass he picked out a whole line of sledges halted to observe the traveller from the south. One Eskimo came running across the ice, evidently intending to stop the explorer. But the latter urged on his team and then, jumping out among his excited dogs, embraced the stranger after the Eskimo fashion. He was a tall, well-built fellow, and his face and hair were thick with icicles. He easily understood Rasmussen's Greenland dialect, and quickly made friends. Very soon Rasmussen was talking to the members of the tribe and noting their strange costume of caribou-skins and great fur-hoods—so unlike the dress of the Greenlanders.

So began the first of a long series of investigations into the mode of life and religion of the American Eskimos. He carefully collected the stories and charms told by the angakoqs, or wizards, in whom the Eskimos have implicit faith. He also found ample evidence of the terrible privations suffered in time of famine: once he met a woman who had lived on the bodies of her husband and children.

Near Lyon Inlet he was the guest of Aua, a notable wizard whose village consisted of five snow-huts, joined together by a long passage with numerous storehouses built off, so that it was possible to go all over the place without exposure to the bitter cold. This was a distinct advantage, since the thermometer stood at −63° Fahrenheit, and every time they picked up their guns with naked hands the cold steel took the skin off. Aua's own igloo was large enough to sleep twenty with ease, and the seven or eight blubber lamps kept the place so warm that it was possible to go about comfortably even when half naked. Aua told Rasmussen all about the great goddess called the Mistress of the Sea, who lives on the floor of the ocean. There was once a girl, he explained, who refused all offers of marriage, until at last she was enticed away by a petrel disguised as a handsome young man. After a time she was rescued by her father, but the petrel raised a violent storm,


ARCTIC
OCEAN
PEARY
LAND
GREENLAND
ELLESMERE
LAND
BEAUFORT
SEA
THULE
Jakobshavn
BAFFIN
BAY
HERSCHEL
ISLAND
BANKS
ISLAND
ALASKA
BAFFIN LAND
Arctic Circle
Blond
Eskimos
VICTORIA
LAND
Mackenzie R.
Musk-ox
Eskimos
King William Island
Felly
Bay
Wager Inlet
SOUTHAMPTON
ISLAND
BARREN
LANDS
Caribou
Eskimos
Chesterfield Inlet
HUDSON
BAY
DOMINION
OF
CANADA
THE "THULE"
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0 100 500
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and her father, to lighten the boat, threw the girl overboard. She clung to the side, but he chopped off, first the tips of her fingers, then the joints, and finally the wrists. As they fell into the sea the wrists turned into seals and walrus, but the girl sank to the bottom of the sea, where she still lives and rules over all the creatures of the ocean. Aua also carefully explained the Eskimo idea of Heaven—a great country with many caribou, and when the souls play at ball they can be seen as the Northern Lights.

Then Rasmussen pushed on again, sometimes through raging blizzards when to make any progress at all backs had to be bent and heads bowed. Since his sledges were so heavily laden he had recourse to the old Eskimo dodge of ice-shoeing. Since peat was not available he worked some flour into dough and spread it on the sledge-runners. After a day's freezing the dough was a mass of ice and so smooth that the sledges ran easily over the dry, powdery snow. Next day Rasmussen was surprised to see a lone sledge approaching, the driver of which turned out to be a constable of the Royal Canadian Mounted Police on his way to Rasmussen's base to make a report. The constable reckoned to be two and a half months on the way, and during the whole of that time he would have no shelter but a snow-hut.

Beyond Wager Inlet Rasmussen followed the coast southward, and at Depot Island had his next surprise when on entering a village of snow-huts out tumbled a little Negro girl! It turned out that the black girl was the daughter of an Eskimo woman who had married a negro cook from a stranded American whaler. Rasmussen stayed for eight days among these Netsilik Eskimos, and collected over a hundred folk-tales and legends. Meanwhile the Eskimo woman attached to his little party was busy making new spring coats, as their heavy winter furs would soon be too hot.

Rasmussen's next calling-place was the Hudson Bay Company station at Chesterfield, where there were a number of log houses and a wooden church. From this point he travelled on into the little known Barren Lands to the Caribou Eskimos, and soon got into a region where white men had never been seen before. On leaving Baker Lake he went on to the Kazan

river, and everywhere found the natives busy hunting caribou. Although it was late in June, the snow was still frozen hard in places, but the Barren Lands were thick with game. At last the head tribe of the Caribou Eskimos was located; and Igjugarjuk, the chief, greeted the explorer with a jovial smile. Rasmussen had already heard of this man on the Kazan river. Apparently he had been refused permission to marry the lady of his choice. Therefore, he went out one day and lay in wait at the entrance to the woman's hut, and from his ambush shot down her father, mother, brothers, and sisters until only his chosen bride was left. Now he had two wives and was a famous wizard. His tribe lived in tents made of caribou-skins, and all the women wore coloured shawls over their skin dresses as Indian women do. For ornaments they wore portions of old watches, some wearing the case and others going shares in the works.

By this time spring had come to the Barren Lands. There were hosts of birds about; ermines and marmots rolled in the grass; and even the wolves had retired to their dens. Rasmussen witnessed the Eskimo method of hunting caribou. Two lines of oblong boulders were set up in an avenue, and on the top of the boulders a tuft of grass was placed to look like a man's head. The avenue was very broad at one end and narrow at the other, and so placed that the driven caribou would find themselves between two lines of these camouflaged figures. The hunters lay in wait at the narrow end of the avenue and took toll of the beasts as they passed.

In conversation with Igjugarjuk Rasmussen learned many things about the elaborate taboo system and, on his departure, was privileged to witness a seance in which the tribal wizards called up their familiar spirits to ensure a safe journey. On the trail next day the party came across the corpse of a woman who had been lost in a blizzard the winter before. The Eskimos said that the woman had gone out in search of her husband, who was seeking food, and that she had been lost in the snow.

It was now decided that two of the white men should go to Baker Lake with the greater part of the ethnographical collections. Igjugarjuk was to take this party down the river with a canoe, while Rasmussen went by sledge. On one occasion the

canoe, with its precious load, was almost lost. Camp had just been made, and the canoe party were just crossing the river when they saw the dogs making for some newly slain carcasses on the other side. In the hurry to save the meat the canoe was not pulled far enough up on shore and when they turned round the canoe was floating away. Then began a mad obstacle race in and out of the water. Although there were masses of loose ice about, Rasmussen managed to swim from floe to floe. His hands were torn and bleeding from the sharp ice before the canoe was reached and dragged to safety. Another few yards and the canoe would have been carried out into the turbulent main river to certain destruction.

The partial break-up of winter conditions meant that the route back to Chesterfield was full of difficulties. Sometimes progress by boat was barred and sometimes progress by sledge. Once they had a narrow escape when some native kayaks which they had hired were crushed in the rocky narrows of a swollen river. Another day they had to cross a lake on a block of ice, with the dogs drawing the mass across by swimming in harness. Finally, after three days of heavy going across sodden tundra, they reached Baker Lake, but could not rouse the people at the trading-post; they had therefore to ferry across on an ice-floe, using skis as paddles.

Most of the next winter was spent at Danish Island, although sub-expeditions explored in Baffin Land and Southampton Island. Mathiassen, one of the investigators, had a narrow escape from death when he violated a taboo by cracking caribou skulls with iron hammers among some Southampton Island natives. Fortunately, one of the expedition Eskimos overheard the plot to kill off the explorer, and so frustrated the attack.

On March 10, 1924, Rasmussen set off again from the base on his long sledge trip through the North-west Passage, with only two Eskimos to help him. He crossed the ice-foot on the shore of Committee Bay to Pelly Bay. The whole region seemed to be one of plenty, although the natives had no wood and made their harpoon shafts out of horn and the points from the hard shin-bone of a bear. They had an ingenious way of using up their tent-skins in the winter. The skins were folded over into long, narrow strips, and raw fish or meat was placed

between the layers. Then the whole mass was frozen hard and used for sledge-runners. When, in the spring, the sledges melted the skins served as dog food and the stuffing as food for the men.

From a tribe who lived near the North Magnetic Pole Rasmussen was able to exchange trade-goods for a valuable collection of amulets, or charms, without which no Eskimo is complete. One girl, who greatly desired some beads, handed over a little skin bag with all her charms and explained them. There was a swan's beak, so that she might have a man-child; the head and foot of a ptarmigan, so that he might have speed and endurance when hunting caribou; a bear's tooth for powerful jaws; an ermine-skin for agility; and other evil-smelling but magic odds and ends.

Rasmussen next visited the tribes of the Great Fish River, and thence went to King William's Land, where he hoped to meet one of his Eskimos, who had been sent off to fetch more supplies. The whole of July was spent in excavating the ruins of an ancient settlement, but the expected supplies did not arrive. Ammunition began to run short; all the tea, sugar, and tobacco had gone. There was still plenty of meat, however, and the coast natives were expert salmon fishers. By the end of August Rasmussen began to think that his emissary must have been killed off by hostile natives, and now that winter was close at hand he was seriously worried by the lack of ammunition and matches. At last, on September 3, the Eskimo returned in a kayak. He had brought no supplies, because the trading-station at Kent Peninsula had sold out. Moreover, the natives *en route* had been hostile so that he had been lucky to escape with his life.

This bad news made it appear impossible to continue the journey to Alaska; but on September 21 there was a sudden commotion in the camp. All the men and women came pouring out of the tents, and a great cry of wonder went up. Rasmussen, gazing out to sea, could hardly believe his eyes, for he saw a ship under full sail, making straight for the Eskimo settlement. The Eskimos had never seen a ship before, and were greatly excited. The vessel proved to be a small yacht which had been sent to establish a trading-station in King

William's Land. The skipper had forced his way through the dangerous Queen Maud Gulf, and so was the second navigator to struggle through the famed North-west Passage. (Amundsen's *Gjoa* had been the only previous ship to pass through.)

Now, of course, Rasmussen was able to get as many supplies as he wanted, and this ensured the success of his journey. Two light sledges were built, and as soon as the ice was ready Rasmussen set off again. One of the last things he did before leaving King William's Land was to seek out the place where the members of Franklin's expedition had died. The Eskimos took him to a place where there were a number of human bones, and scraps of clothing and footwear lying about showed that the bones were those of white men. A cairn was built over the remains, and flags were hoisted at half-mast. So nearly eighty years after they had died these heroes of the famous exploit were awarded their belated honourable burial.

Along the shores of Bathurst Inlet and Coronation Gulf Rasmussen continued his investigations among the natives, and collected large numbers of songs from the Musk-ox Eskimos. This brought him to the land of the 'Blond Eskimo,' where some of the men had reddish beards and blue eyes. Since these people had already been visited before, he did not stay there long, but pushed on to the Mackenzie Eskimos. Here he found himself in a new world, for the natives had become prosperous and semi-civilized because of the remunerative trade in skins. Many of them owned schooners; the women used sewing-machines; safety razors and cameras were not uncommon; and some of the men who could read and write had bought typewriters. Even here, however, Rasmussen found that the veneer of civilization was not deep, and he collected many more legends and stories to compare with those he had gathered from more primitive tribes.

At Herschel Island he visited the headquarters of the Mounted Police; and on May 5 entered Alaska. Beyond lay 500 miles of flat tundra, with a few scattered tribes along the coast to Point Barrow, the first real town he had visited since leaving Greenland three years before. The homeward journey was via the Behring Straits to Seattle, and thence across America to New York. This portion of the journey was natur-

ally a great adventure for the Eskimos, and as they stood on the roof of a skyscraper one of them said, " Those tiny beings live on a great plain of stones made with hands . . . there is no game to be seen anywhere, and yet they manage to live and find their daily food. I see more things than my mind can grasp."

15

GREENLAND'S HIGHEST MOUNTAIN

THE TRAGIC death of Gino Watkins in 1932 at Lake Fiord has not deterred the brilliant band of young British explorers who in recent times have made Greenland the centre of their activities. In particular, they were eager to explore still further the region around the forty-mile-long fiord—called Kangerdlugssuak—in East Greenland. While flying over this fiord Watkins had seen to the north-west a great mountain chain which appeared to be higher than Mount Forel or any other peak in Greenland. Since these mountains were too far away from his base, Watkins had been unable to visit them; but the banner was taken up by Augustine Courtauld, whose lone vigil on the inland ice-cap had been one of the most courageous incidents in the expedition. Martin Lindsay also tried in 1934 to reach the new range by sledging right across the ice-cap; but, although he sighted the range, he found it impossible to reach it. Two years later Courtauld and Wager planned a joint expedition to the same region. Courtauld's main objective was the Watkins Mountains, but Wager proposed to stay on through a whole year and to make geological and biological surveys. The expedition also was daringly novel in that the explorers were accompanied by their wives.

On July 4 the party, totalling fourteen, sailed from Aberdeen. Eleven days later their ship, the *Quest*, was struggling through the close pack-ice. There were many icebergs in sight. Towards evening the ice-floes jammed so tightly around the ship that the propeller would not turn, and they drifted helplessly, at the mercy of a strong current. Before long the situation began to be really dangerous, as the current drifted the ship steadily towards a line of bergs. Dynamite was used in an effort to free the ship, but unsuccessfully, since the sea froze again almost as soon as the holes could be made. The captain finally decided that nothing more could be done; and, since a crash seemed inevitable all hands prepared to

abandon ship. The men took out provisions, while the women prepared all the personal gear, and everything was made ready for transferring to one of the ice-floes alongside. For the next two hours it was touch and go. Then the current set in round the ugly ice-mountain looming ahead, and the ship cleared the obstacle with a few yards to spare.

The next day the ship was met by a fleet of kayaks, and the members of the expedition were soon making friends with the local Eskimos. A number of hunters and their wives were engaged to accompany the ship to the fiord, and they brought with them their children, skin-tents, dogs, and kayaks. For the next two days they steamed northward along the coast, and reached Watkins's old base on Lake Fiord. Then fog came down as they steered on through the pack, and the *Quest* was carried some twelve miles out to sea by the current, where they were surrounded by heavy pack for some days. On August 2 Kangerdlugssuak was reached, and the Eskimos were landed while the ship pushed on northward to reach a convenient place for the inland journey to the mountains. However, before the selected spot was reached a gale sprang up; the ice came in rapidly, and the captain only just managed to turn the ship in time to prevent it being nipped between the ice and the high cliffs. They ran into the nearest open fiord, and decided to use that as the base.

A prospecting party was sent out to see if there was a route up the glacier at the head of the bay, and it was discovered that apart from a steep ice-fall the way was fairly easy. By this time the women had assembled all the gear, and a party of six men set off for the mountains with a supporting party of three and enough food for four weeks. They made for a pass over 3000 feet high, which they hoped would lead them to the great Sorgenfri Glacier. The going was very hard, as the snow was soft, and it took nine men to haul one sledge on the higher slopes. From the top of the pass they could see Watkins Fiord to the south-west, whilst to the north-west rose the imposing southern face of the Watkins range.

The following day they pushed on towards the glacier, but were held up by deep snow and also by a steep drop of 1000 feet. A rope was belayed to several ice-axes, and then, with all

the men hanging on, the sledges were gradually lowered. Below they found a small outcrop of rock, and made their camp there. A further detour was made necessary because the Sorgenfri glacier was in a very bad state. From the top of the next pass they obtained a magnificent view of the mountains which, although still about forty miles away, dominated the landscape.

Next day the party dropped down on to the glacier immediately below a formidable ice-fall full of crevasses. Wager and Longland prospected a route through the worst places; but the weather was warm, and the snow-bridges began to melt before the sledges could be got through. Finally, with all the men roped together, they picked their way through the treacherous places and reached the level upper part of the glacier. Here the supporting party turned back, and the main party pushed on fifteen miles over a plateau on a good surface, and camped at a height of about 6000 feet.

The next stage was to find a route down to the huge King Christian IX Glacier, which lay between them and the mountains. As it was 2000 feet below the level of the camp they expected to have some difficulty in reaching it. Soon they reached the edge of the plateau, and saw that beyond an unpleasant-looking glacier dropped down to the lip of an ice-fall. Still farther down lay the great glacier, about twelve miles wide, and beyond that towered the 7000-foot southern wall of the Watkins range, topped by three snowy summits. There were many crevasses to negotiate on the way down, and on the ice-fall it was difficult to lower the sledge through a complicated system of ice-cracks, where a slip on one of the narrow bridges would have meant the loss of all the equipment.

However, by travelling at night time, when the frost was most severe, they managed to descend to the glacier, and landed on a rocky point where there were traces of coal. They had been afraid that the glacier—which is over a hundred miles long and one of the largest in the world—would prove to be badly crevassed, but to their amazement they found the surface smooth and level and dotted with frozen lakes. Rapid progress was made to the foot of the range, although some of the men

suffered from slight snow-blindness owing to the glare from the wide expanse of level snow.

Early next morning, having made a depot of supplies, the climbing party set off on skis for the glacier, which winds down from the summit of Watkins Mountain. For the later stages of the climb they had to tow their skis, but by noon they had reached a height of 9500 feet and seemed within striking distance of the summit. Then it seemed as if a tough ice-fall would cheat them of victory; but Longland managed to find a route, where, by cutting steps up a steep place, it was possible to reach the summit. The sun was getting low, and it was very cold; but the victors boiled three thermometers, and made other observations, finding that they were at a height of about 12,200 feet—the highest point in Greenland.

Slowly they worked their way down the mountain, and all reached camp safely, where to their surprise they saw three Ivory Gulls flying about—an uncommon sight in the heart of Greenland, where no food is available. For the homeward journey they chose a new route which permitted an exploration of the great southern wall of the range. They crossed the great glacier again towards a new pass—which avoided the difficult ice-fall of the outward journey—making a rapid march, in spite of bad ice conditions, back to the base on the fiord.

After an exciting escape from pressing icebergs supplies were landed in Kangerdslugssuak for Wager's winter party, and then the *Quest* sailed for home. The wintering party included seven Europeans and fourteen Eskimos. Huts were built; and during the autumn routes up the Frederiksborg glacier to the ice-cap were surveyed. Throughout the next spring and summer extensive journeys along the glaciers and on to the ice-cap were made. The Cathedral Mountains and the Prince of Wales Range were explored; and on the second spring journey a party travelled up the Hutchinson Glacier on the west side of the fiord.

On this occasion they dumped about half their food on the north side of the glacier, and then went off with six days' rations to explore the mountains. After the third day there was almost continuous snow and mist, and for the next six days they had to manage on short rations as they struggled back to

the dump. However, having arrived at the depot, they found that there had been a fall of about ten feet of snow, and this had obliterated all the landmarks by which the dump had been fixed. For four hours they probed about, trying to find the food-boxes, but in the end gave up the task as hopeless. During the next two days conditions were so bad that the party only went six miles, and by that time the famished dogs were refusing to pull. Since man-hauling was out of the question in the deep snow, all the equipment, sledges, and dogs were left, while the men went off on skis in a desperate effort to reach a food-dump ten miles distant which had been left earlier on. After twelve hours they reached the depot, had a good feed, and then set off back with food for the dogs. Even then their troubles were not over, for there had been a snowfall of over fifteen feet, and whenever they tried to walk without skis they sank in to their waists. Fortunately, two days' travel brought them on to the sea-ice of the fiord, and there the dogs were able to race home to the huts.

The ice-cap journeys also were not without their difficulties and dangers, but in the end the whole party arrived home safe and sound, having accomplished several journeys of over two hundred miles through country largely unexplored. In addition, a comprehensive study of the geology, botany, and climate of the Kangerdslugssuak region had been successfully concluded.

16

THE VIGIL AT MID-ICE

RECENT EXPEDITIONS to Greenland have been as much concerned with meteorology as with surveying, for two reasons. In the first place, accurate weather information is required if the Arctic air route, beloved of Gino Watkins, is to be practicable; and secondly, the weather of most of Western Europe is probably much affected by conditions in Greenland. Professor Alfred Wegener, who understood as well as any man the difficulties and dangers of the great ice-cap, determined to provide the necessary information by establishing a weather-station for a whole year in the very centre of Greenland. Situated some 250 miles from either coast, the main object of the station would be to record conditions during the Polar winter, since summer conditions were well known. In addition, small observation balloons were to be sent up into the higher atmosphere, and the thickness of the ice-cap was to be measured by the seismic method. This method involves the explosion of a charge of dynamite and the measuring of the waves reflected from the solid rock beneath the ice by a seismograph. Actually this part of the work was accomplished by Dr E. Sorge, who found that the ice was 6000 feet thick and probably heavy enough to cause the centre of the land to sink and the edges to rise up to form Greenland's "icy mountains."

Wegener was anxious to try motor-sledges for carrying the heavy loads of supplies and instruments on to the ice-cap, and in the autumn of 1930 performed prodigies of labour in getting the stores moved from the coastal base on to the ice-cap. Unfortunately, the motor-sledges failed to reach Mid-ice in the first season, and this meant that the heavy loads had to be taken by dog sledges. In the end this failure of the transport arrangements almost ended in complete disaster. The hut intended for the central station never arrived; and in an effort to bring the men at the station sufficient supplies to last them Wegener himself and an Eskimo companion perished.

In accordance with the original plan Dr Georgi set off in July 1930 for the inland station. After sixteen days' sledging he arrived at the chosen spot with one assistant and four Eskimos. When they had erected a tent and a small hut and arranged the thermometers and other instruments Georgi's companions returned to the coast. It was arranged that Georgi should be joined later by the rest of the central party, but for the time being he was to hold the fort alone. The weather was fine and sunny, although at sunset the temperature in his tent fell rapidly to below freezing-point. However, he kept himself very warm by digging a pit to contain the barometer and other instruments. Then he constructed another pit, which he lined with blocks of hard snow, where he could fill the small observation balloons. Later on these pits were to be very considerably developed until Mid-ice became a perfect warren of underground ice-chambers.

At midday on August 18 Georgi saw through his telescope the small black dots which heralded the arrival of Loewe, with further supplies on five Eskimo sledges. At this time the motor-sledges were being hauled up a glacier, and every one was confident that they would soon set off with the bulk of supplies and the winter hut for the interior. Next day Loewe's party set off on their return journey to the coast, and once again Georgi was left alone to carry on his records. By September 11 the temperatures were getting so low that the alarm clock stopped and would not go again until Georgi thawed it in his sleeping-bag.

With the temperature dropping at times to −36 degrees the Doctor began to wonder how long he could continue to live in a tent. Every day now he looked out for the expected motor-sledges with the heavy winter hut and provisions. Meanwhile Dr Sorge, who was to be Georgi's companion, had set off in advance of the motor-sledges, which appeared to be working satisfactorily. Sorge found the snow soft, with bad visibility and at times heavy driving snow. By the time he had reached the half-way station he realized that the motors must have broken down.

Sorge reached Mid-ice on September 13, having brought over a ton of cargo on ten sledges. With Georgi and his other

companions he discussed the serious position which had arisen by the non-arrival of the motor-sledges. They decided that two men could live on the stores provided for ten or eleven months. Sorge and Georgi wrote a letter to Wegener in which they said that they agreed to winter at Mid-ice together even if the hut did not arrive. They insisted, however, that, unless further fuel and other vital supplies were brought, they would return to the coast by October 20. This letter was taken by Wolken and the Eskimos back to the leader, while the two scientists made themselves as comfortable as possible, continuing to make observations.

They had to improvise oil-lamps as the real lamps were dumped somewhere on the trail to the coast. While optimistically marking out a space for the promised winter hut, they took the precaution of digging a large underground room in the ice. To keep the snow out of the pits they had to build high walls of snow blocks. The weather now became very bad, and the thermometer fell frequently to below −40 degrees. The tent was getting very shabby, and the thick frost which formed in the interior often fell into the sleeping-bags or on the lamp, where it froze into solid slabs.

On October 4 they were much cheered by a visit from an Arctic fox, which dug several holes in the snow to find discarded offal. They wondered if the fox heralded the approach of the long expected sledge-party. Two days later, however, the relief party had not arrived, and now they decided to abandon the tent and live in the ice cavern. A few days later they had a feast of sardines and herrings to celebrate a temperature of −60 degrees; but by that time they had made the underground rooms moderately comfortable, and they found that the cold did not seem so bitter once they were sheltered from the wind. Since they had to have a certain amount of fresh air, they arranged a scheme whereby they could measure the amount of foul air by the brightness of the oil-burner. They were short of fuel, and were very alarmed when they found that some of the petroleum had decomposed in the bitter cold and now burned with a sooty flame, which soon converted their crystal home into a black hole with stream-

ing rivulets of sooty thaw-water. Later they found that this nuisance could be overcome by stirring the fuel well.

Meanwhile Sorge was busy digging out a shaft going down into the ice at an angle of forty-five degrees. He wanted to make investigation into the structure and stratification of the snow. October 20 came and went without the promised extra supplies. "Things have clearly reached the point of disaster," wrote Georgi, in his diary. They now had to decide whether it was safer to hang on at the station with their inadequate supplies or whether to make the long trip across the ice to the coast. They decided that after all it would be better to keep the station going, because not only might Wegener arrive at any moment but their hand-sledge was so inefficient that the journey to the coast would be perilous in the extreme.

The two scientists had almost decided that they had been abandoned for the winter when on October 31 a young Eskimo, Rasmus, arrived in camp, and was followed soon afterwards by Wegener and Loewe. They had begun the journey with fifteen sledges, and now arrived with only three—quite worn out by a forty-day battle through terrible weather, and without food or petroleum. All three men were frost-bitten, Wegener and the Eskimo slightly, but Loewe's feet were so bad that it was at once clear that he could not make the return journey, but must winter with the others. Wegener explained that twelve of his thirteen Eskimos had turned back because of the blizzards, and eventually the three heroes who had struggled on had been forced to dump all the nice things intended for Georgi in order to save their own lives. Now he was anxious to start back again with Rasmus immediately.

"With their dogs pretty well worn out it is a race with death," commented Georgi.

But many difficult months of lonely vigil at Mid-ice lay before Sorge, Georgi, and Loewe before they learned of the tragic sequel. As soon as Wegener had left them they had to set about the task of nursing Loewe, whose mortified toes needed rubbing for hours on end. It soon became clear that they would have to amputate some of the toes although they had no book on frost-bite, no surgical instruments, and no proper bandages. For five days they did all they could, but finally

had to perform an emergency operation. In spite of the fact that the only local anaesthetic they had was fine, powdered snow, Loewe bore himself like a hero, and at last the horrible job was done. Of course, the poor fellow was still obliged to remain inactive in his sleeping-bag, and later on further small operations became necessary for the removal of all his toes.

On November 13 the alarming discovery was made that in spite of their economy measures they had been using far too much petroleum. Thus on odd days they were obliged to manage without using the stove at all. All the time there was the dreadful worry that Loewe might develop blood-poisoning or that the infection might spread. The scanty store of cotton-wool and bandages gradually melted away, and the invalid was still confined to his bed. Then to add to the worry and discomfort they found that Loewe had picked up some lice from the Eskimos on his outward trip. The lice hatched out in myriads in the warmth of the sleeping-bags.

In his diary for November 28 Georgi writes:

> Nothing fresh from the theatre of war. We are carrying on the war against our new pets with heat and cold. Loewe's sleeping-bag and clothes and my underclothes are hung out at night in —22 degrees. . . . Loewe's ski-ing shirt, which contains five or ten thousand eggs, I ironed inside and out yesterday with a ski-clamp, and hope I destroyed the eggs or at least severely damaged them. . . . The woollen stuff is so wonderfully woven in little folds, and each fold is naturally a paradise and breeding-place for lice.

Loewe soon showed, however, that he intended to do what he could to help. He interjected one humorous or clever remark after another, and extemporized lectures on Polar exploration. He was also able to help to a certain extent in the scientific work which still went on.

Christmas Day came and went, and then Georgi fell a victim to acute tooth-ache. His face swelled to an enormous size; but he failed to extract the tooth with a pair of pliers and a screwdriver. The month of January dragged past. After just three months in bed Loewe got up for the first time. He was very weak, and soon had to go back again. Indeed, all told he spent over six months in bed, suffering fresh operations

from time to time as the toes refused to heal. In the end, however, the operations did prove successful and eventually Loewe was able to walk well with special shoes.

Meanwhile they had discovered that the warmth of the ice-chamber had affected the roof of their dwelling and there was every possibility that the roof would collapse. This menace they had to overcome by building supporting pillars.

On May 8 Sorge was busy drying clothes up above when Georgi came out to make the midday observation. Suddenly he asked, " Was that black spot away to the westward there yesterday? " and, rushing to the theodolite, cried out, " The motor-sledges! Wegener's coming! " They shouted the news down to Loewe, and in a few moments the sledges with their humming aeroplane motors swung round and charged up to the station.

The rescue party came up crying out, " Are Wegener and Rasmus with you? " Then for the first time they all realized that Wegener must have died on his return trip.

17

EXPLORING NORTH-EAST LAND

BETWEEN 1921 and 1924 Oxford University sponsored three expeditions to the Arctic, under the leadership of George Binney. Besides the usual exploratory work Binney undertook to try out a topographical survey of North-east Land from a seaplane, and also to collect geological and biological specimens. The 1921 expedition was more or less experimental; but a journey was accomplished on the New Friesland ice-cap in Spitzbergen, and in 1923 and the following year an effort was made to explore the more difficult North-east Land. This island, which is about ninety miles square, lies to the north-east of the main island of Spitzbergen; and apart from a brief expedition in 1873 by Nordenskiold no effort had been made to penetrate into the unknown interior of some 8000 square miles. In normal years the north and east coasts are unapproachable because of thick pack-ice, while most of the interior is covered by a vast ice-cap, bounded either by rocky cliffs—as on the west coast—or by ice-cliffs a hundred miles long—as on the east side. It is a land of sudden mists, devastating blizzards, treacherous crevasse-shattered glaciers, and icy streams of melting snow.

Two ships were chartered for the 1924 expedition, the *Polar Bjorn*, a sealing-vessel of 164 tons, and the *Oiland*, a small sealing-sloop. The crews were Norwegian, and some of them, who were experienced in Arctic conditions, accompanied the sledging-parties. The veteran was Helmar Hanssen, who had been with Amundsen to the South Pole and through the North-east and North-west passages. His experience was to prove invaluable. An Avro seaplane was bought, and ground engineers and pilots selected from a large number of volunteers. The scientific party included eight Oxford men and four Cambridge graduates.

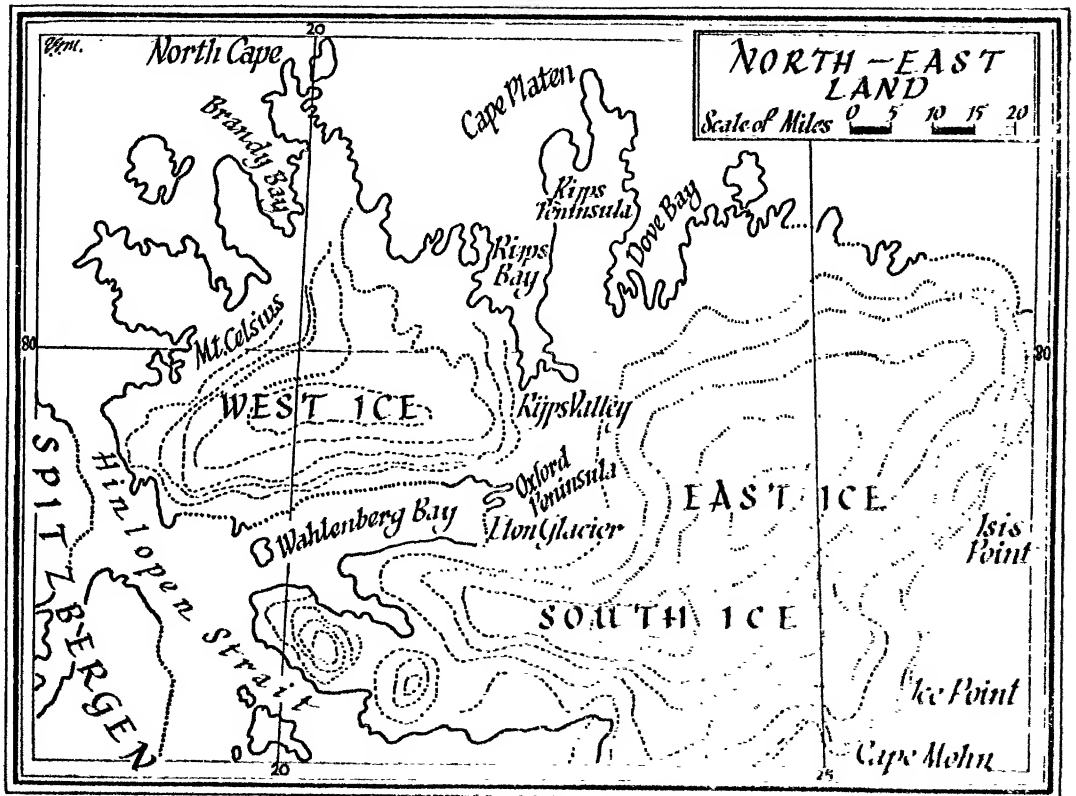
The whaling station at Green Harbour was reached on July 3, and the heavy work of landing the crates containing the

seaplane parts began. An old whaling platform was used as an assembly field, and while the ship went on to Liefde Bay on the north coast of Spitzbergen the seaplane was made ready for a flight to the advanced base. By July 14 everything was ready for the seaplane's flight to Liefde Bay, where the *Polar Bjorn* had established camp. The *Oiland* was to follow on from port at Green Harbour.

It was a raw, misty morning when Binney and the pilot, Ellis, set off. They were wearing sledging-suits and fur sealing-caps on top of their ordinary clothes, since there was a freezing wind blowing off the ice-cap. They hoped to reach the camp in two hours via the station at King's Bay. Very soon they flew into fog and dropped to about 400 feet, since it was difficult to pick up the landmarks. The engine was running smoothly in spite of air pockets over the glaciers, and after about an hour's flying they could see the mouth of King's Bay. Suddenly, without a moment's warning, the engine stopped, and before they had time to think about a landing they were down on the water. The pilot and his leader had no idea what had caused the failure, and were so intent on seeking a possible fault that they did not notice that they were gradually drifting northward away from the coast.

Since the seaplane was not equipped with a collapsible boat, their only chance of reaching the shore was to make some sort of oar. Two ice-axes were disentangled from the sledging-gear in the fuselage, and with the help of a saw from the engine tool-kit the lid of a three-ply sledging-box was cut to form two paddle blades. Since there was only one nail available, the second blade had to be tied on to its improvised shaft with string. Altogether it took an hour to construct the oars. All this time the wind had been blowing the seaplane out to the open sea at the rate of three knots.

Sitting astride the floats they attempted to guide the seaplane towards land, but, since the wind was freshening, it soon became clear that little progress was being made. The waves were rising, and in order to avoid being swept overboard it was necessary to hang on with one arm and leg to the struts. For three hours they paddled furiously, in desperate expectation of reaching one or other of the headlands as they slowly drifted by;


NORTH-EAST LAND
Scale of Miles 0 5 10 15 20
North Cape
Brandy Bay
Cape Platen
Kipps Peninsula
Dove Bay
Kipps Bay
Mt. Celsius
WEST ICE
Kipps Valley
Oxford Peninsula
Hon Glacier
Wahlenberg Bay
EAST ICE
Isis Point
SOUTH ICE
Hinlopen Strait
SPITZBERGEN
Cape Mohn
80
20

but in the end they had to give up and clamber back into the cabin, hoping that one or other of the expedition ships would soon come to their rescue. When the plane was reported as missing at King's Bay both ships would at once set out to seek for them. Gradually, however, they were drifting away from the probable line of search; and there was always the possibility of a dense fog reducing the visibility to zero.

Meanwhile in a further effort to stop the drift a canvas tool-bag, filled with heavy gear, was suspended from the under-carriage on a rope to act as an anchor. Ellis also set the ailerons so that the wind would veer the machine shoreward; but these measures had little effect. Soon they began to be assailed by a raging thirst, since they had never foreseen a landing on salt water and so had no drinking supplies, except a little brandy and some concentrated lime-juice. Ellis sampled the extract, but it burned his mouth; and Binney found his tooth-paste equally disappointing. With the open sea well in sight the seaplane began to pitch and toss in the trough of the waves, and they finally thought it wise to put on life-jackets, since she could not stand such a buffeting for long. Off Quade Hook they saw a small hut, and fired a gun to attract attention; but nobody took any notice, and the plane drifted out of King's Bay into the open sea.

By midnight five-foot waves were breaking over the lower planes, but the pilot had such faith in the strength of the floats that he announced his intention of ' turning in.' Half an hour later, however, he thought it necessary to cut the petrol pipes to make the sea calmer round the plane, and at the same time lighten her.

At 1 A.M. he said quietly, and most unexpectedly, " There is a boat following us. We have been sighted." Sure enough a little motor-boat had put out from Quade Hook; and so after fourteen hours of drifting across the Arctic seas the expedition plane and its leader were rescued.

This inauspicious start did not delay the setting up of a sledging-base at the mouth of Wahlenberg Bay, in Hinlopen Strait—the strait which separates North-east Land from Spitzbergen. Three sledging-parties were organized, which were to explore respectively the north, the centre, and the south of the

island. Meanwhile the seaplane, when she had been repaired, was to attempt a photographic survey of the coast.

The northern party set off on July 21 with two loaded sledges and four men. The dog-driver was Lindquist, a typical Spitzbergen trapper, who refused to be roped even amongst the worst crevasses. The Englishmen—Aldous, Carslake, and Montague, an Oxford long-distance runner—found the going terribly hard. A good deal of their time was spent in harness helping the dogs to pull the sledges across deep, slushy snow—frequently in a thick fog. The absence of a heavy frost meant that ice-rivers had to be forded every few minutes, and Lindquist declared that he never thought it would be possible to swim across the North-east Land. The dog pemmican also proved unsatisfactory; and the miles of swamp snow and thick fogs soon made it clear that provisions would be short on the return trip from the north coast. The sledges were frequently ditched or upset, and here and there they had to rush across deep, thawing streams over shaky snow-bridges.

Ten days of dreadful going at last brought them to Mount Celsius, from the summit of which it was possible to survey a large area in the intervals of clear weather. Four days later—after struggling through a region of cross-crevasses which often engulfed the dogs—the summit of Snow Hill was gained—and by good fortune they were able to survey from this point a large extent of the north coast. The spell of dry weather meant that for the first time since they started they went to sleep with their clothes dry.

The next day Lindquist and Montague went down to the shore, in a vain effort to shoot a seal or a bear for dog food, since only six days' rations remained for the hungry animals. While they were on this fruitless trip a sudden hurricane sprang up, and only by the greatest good fortune was the tent saved from utter destruction. The journey back began badly through soft snow, and one of the dogs soon gave in and refused to pull any more. The dog-food situation was rapidly getting critical, and when they were held up by a blizzard on August 11 they began to meditate killing the weakest dogs to feed their brethren. But the blizzard was a blessing in disguise; and once they were able to march again they found the surface so good that

the next day they advanced twenty miles. On August 15 they reached the sledging-base to find the centre party also safely returned.

This party, led by Frazer, the surveyor, had tried to reach the south-east corner of the island; but they had discovered that the way was blocked by Wahlenberg Bay, which, to everybody's surprise, extended for forty-one miles into the interior. Consequently they were forced farther and farther into the very heart of the ice-cap, and never reached their objective. They too found the going very hard through deep, wet snow, as is indicated by the names of the first two camps—Slush Camp and Fog Camp.

On the third day out they came to a valley which was riddled with crevasses, where the poor dogs were up to their bellies in snow and slush. Very often the sledges jammed, with the frozen slush well over their decks. They camped on the edge of a crevasse; and when they woke next morning they found the crack had opened up a few more yards, and one of the dogs was hanging in it. At the head of the Bay the snow swamps were worse if anything, and they had to turn northward, struggling through ice and water up to their knees. At length they came to a hopeless mess of thawed snow and crevasses, and could get no farther with the sledges. However, a further reconnaissance was made on skis, and a great glacier at the head of the Bay was discovered.

Meanwhile the *Polar Bjorn* had been making a reconnaissance along the south coast of North-east Land. When they reached Cape Mohn, the south-east cape, they found, to the amazement of the captain, that a northerly gale had swept away all the ice-floes, and that the east coast was clear. This was a tremendous piece of luck, since the east coast has been rarely seen and a landing had never been made there. When Binney heard this good news he decided to land a sledging-party on the east coast, and so accomplish the first crossing of North-east Land. He found that the coast was fringed by a great ice-cliff over a hundred feet high, but at last came to a place named Isis Point, where the gleaming barrier was broken by a low-lying spit of rock. Sledging-gear was forthwith landed, and on August 5 the party set off with Hanssen—of immortal fame—in charge of the

five dogs. Since Tennant, the appointed leader of the party, was not fit, Binney himself took his place, having made arrangements to be picked up twelve days later in Wahlenberg Bay.

The first march began well, as there was little snow on the ice-slope up to the plateau. Soon, however, they came to soft snow, and at last were halted by an ice-river fifteen feet wide. They followed its bank until the stream plunged into a large crevasse, where they camped. Bright sunshine next day produced a thaw, and the sledge soon wallowed deep into the morass, and had to be dug out. In order to avoid the worst areas it was necessary to make wide detours, and it was not until the third day that a good march was accomplished. By this time they had reached the top of the ice-cap, which was utterly featureless and as smooth as a billiard table.

Then followed two days of fog; and after the half-way mark had been passed the country began to get more difficult. Here there were many 'ice-canals.' These were chasms forty or fifty feet broad, and about as deep, which were choked with masses of congealed snow. These obstacles had to be crossed by snow-bridges flanked by crevasses into which the dogs frequently fell.

Nine hours' heavy marching brought them to the end of this queer district, and then for a short spell they made good progress over smooth ice. Shortly, however, they were floundering in a badly crevassed area again, and once were on the brink of a catastrophe. The sledge was being drawn along a narrow incline, with a crevasse on either side, when it slipped over the edge and fell lengthways into the crevasse, dragging the dogs with it. All the food and bedding was on the sledge, and they were still fifty miles from the base. Fortunately, the bedding, which was lashed on the top of the sledge, bulged out considerably and caught on an ice buttress a few feet down. The dogs were soon hauled up, and a rope made fast through a sledge-runner, and then with infinite care the provisions and the sledge were rescued.

Shortly after this episode a blizzard kept them tent-bound for twenty-four hours. On resuming their journey they had not gone very far before huge crevasses were yawning on both sides. Twisting and turning to avoid the thousand-foot chasms, they soon came to the conclusion that there was more crevasse than

glacier in this district. Even when they camped they had to make do with a patch of firm ice no bigger than a table-cloth, the dogs having to be tethered to the sledge with the greatest of care. When the sun reappeared through the eternal mist they saw that they had reached the centre of a great glacier—the Eton Glacier—at the head of Wahlenberg Bay.

Although they were delighted by this view of previously unknown territory, they were perturbed by the glacial devilry which lay in front. They had to negotiate an ice-fall, cross an extremely difficult area of seracs and crevasses, and then climb out on the other side. The sledge was lowered inch by inch from one resting-place to the next, and the dogs had to be brought down separately. Once they bolted and dragged the driver into a crevasse; but he hung on, and they promptly pulled him out again. In the great ice arena they threaded their way past ice-cliffs and grottos and along the bank of a deep blue frozen lake. Once off the glacier, however, the going improved, and on the morning of August 15 they sledged down to the shores of the Bay, where they were picked up at midnight by the *Polar Bjorn*. Thus ended the first crossing of North-east Land, in a direction by which nobody had ever thought it would be crossed.

Meanwhile the seaplane had been mended, and after a good deal of trouble a certain amount of survey work was done along the coast of Hinlopen Strait. The *Oiland* accompanied the plane, acting as a base. This was just as well, for on the third photographing flight the plane had only just taken off when it crashed on the shore at the north end of the strait. So the experiment in air survey was not a great success, although many useful lessons were learned for the benefit of future airmen exploring the Arctic. Moreover, a good deal of geological and botanical information had been gathered; and the youthful band of explorers returned home rejoicing in the knowledge that not even a single dog had been lost.

18

EXPEDITIONS IN SPITZBERGEN

AFTER BINNEY'S successful expeditions there was a lull for several years, until the Oxford University Exploration Club was founded in 1927; and it was not until 1933 that a new expedition was sent to the Spitzbergen area. The leader this time was A. R. Glen, and, although he started with the firm intention of confining the members to Oxford, in the end his party included six Cambridge men. The main objective was New Friesland, the north-eastern part of Spitzbergen, which was almost completely unknown. Three parties were to be landed in Treurenberg Bay, at the north-eastern corner, and they were to work southward across the unknown territory to a base camp in the Ice Fiord. Two of these northern parties were to work with sledges, and were to attempt to measure the thickness of the inland ice; while the third was to travel along the coast of Wijde Bay, and so map the western coast of New Friesland. Meanwhile the base party were to explore as much of the land around the camp as they could manage.

On the northward voyage in the *Isbjorn* they were accompanied by Lindquist, who had been such a valuable member of Binney's expedition. Lindquist was bound for the west coast of North-east Land on a hunting trip with a companion. Later on the Oxford explorers learned of the strange fate which befell him. In July 1934 when the *Isbjorn* took supplies up to Lindquist's hut the crew found that the hut was half burned, the roof was off, and the interior filled with snow. Lindquist was sitting at the table, dead: his companion, who was lying in a blood-stained sleeping-bag, was also dead. The last entry in the log had been made six months before. It was difficult to reconstruct the cause of this Arctic tragedy, but it seems probable that some accident happened which made it impossible for the hunters to survive the terrible winter night.

On July 11 Treurenberg Bay was reached, and the supplies for the sledging-parties landed. Then a reconnaissance party

set off up the Duner Glacier, and crossed the inland ice-cap, with a heavy load of food and equipment, in order to lay a depot about forty miles to the south. The first few miles of travel up the glacier were easy, but half-way up they were forced to make a long detour by a succession of stagnant pools. Above this rose a steep ice-bank, covered with melting snow. When this had been overcome they found the way barred again by a long line of small lakes.

The one route open lay across rotten snow which had drifted over crevasses during the winter; and they had only advanced a hundred yards when the leader went through to the waist. He was hauled out without much difficulty; but for some time afterwards they had to be wary of tottering snow-bridges, and made slow progress. The slush too packed under the sledges, and made them very hard to move. In the end they had to wait until a night-frost made the going better, and the next two stages were completed during the night.

On the fourth day they suddenly came in sight of the southern mountains, and for the next three days were able to admire the jagged purple peaks of the Stubendorff Range and the distant ice-floe of the Lomme Bay Glacier. Then the depot was laid, and the return journey began.

On the Duner Glacier they met the first sledge-party, and the real work of exploration began. During the next six weeks the greater part of North Friesland was explored, and geological specimens collected from the outcropping rocks. The work was hindered by the usual bad visibility; and it was easy to get lost. On one occasion one party thought they had discovered a new mountain range which loomed up through the mist, but after climbing a snow ridge they found that the mountains were on the other side of the Wijde Bay and quite ten miles away. By that time they had strayed so far that the problem of finding the tent became acute, and it was some time before, through the glasses, they caught sight of the black shadow on the snow-field which denoted the camp. Sometimes they travelled across a white desert which merged into white mist, and sometimes their goggles were clogged with driving snow. At last they began the journey towards the base, and as they left the ice-cap they came to some glaciers which were a maze of ice hummocks

and crevasses. On the first glacier they became tired of hauling the sledges, and decided to let them run across the glacier on a series of traverses by their own power. However, no sooner had the first sledge been released than it performed a beautiful piece of unexpected cornering, and disappeared down the glacier at about forty miles an hour. The explorers tore after the sledge, and found that by a great piece of luck it had come to rest on the very edge of a series of ice-falls which would have smashed it into bits. A little farther on the glacier passed through fantastic rock gorges, where there were so many pitfalls that it took hours to progress a few hundred yards. In the end they had to use crampons to get a grip on the slippery surface, but after five hours of ticklish work here they suddenly came within view of Petunia Bay, at the edge of which stood the base hut.

Meanwhile the party which had been trying to measure the thickness of the ice by the seismic method had found that their instruments were put out of action by the low temperatures; and they finally had to make their way down to the base without any satisfactory results. The third party, which had been making its way down the coast in a boat, had once climbed a high mountain from which they obtained a view of the whole of New Friesland. A little later, when they were returning to camp, they came across some totally unexpected footprints; and as they were searching around for 'Man Friday' were hailed by a man who turned out to be a Norwegian hunter. They spent several days with this hunter, who explained that he had a hut farther up the bay, and was responsible for tending about two hundred traps. While in this district they climbed some of the peaks in the neighbouring mountains, and sighted range upon range of unexplored country.

From the base in Petunia Bay several journeys were accomplished, some by boat and some on foot. The currents in the bays were a considerable difficulty; and once Mann, the leader of the base party, spent four days trying to reach the entrance of Sassen Bay in a whaleboat. The wind set steadily against him, and he had to row all the way. On the third night he chose for his camping-place the site of a tern colony. Next morning he was aroused by the furious onslaught of the pecking

birds, and made haste to get away. At the last minute he went to fetch some water from a small stream, and when he turned round the boat had drifted out from the shore. Poor Mann had to strip and swim out through the freezing water to rescue the boat. Two days later he reached the coaling-station for which he had set out; and from there, taking advantage of a favourable wind, sailed back to the base in ten hours.

On another occasion the whaleboat was used to investigate a bird colony on the face of a glacier. The sea-front of this glacier was about two and a half miles wide, and in places the cliff was a hundred feet above water-level. The glacier face was constantly 'calving'; and once, when the boat was about forty yards from the edge, a huge chunk of ice broke off the face, and immediately afterwards the whole cliff above them fell slowly outward, with a terrific roar. With great presence of mind Hartley, the biologist, kept the boat straight as they were enveloped in a thick wall of spray. A fifteen-foot wave lifted the boat like a cork; but fortunately for the explorers the iceberg split up into large lumps before it reached the boat, and no damage was done.

By September 15 a large programme of work had been accomplished, and a few days later the *Isbjorn*, which had been delayed by storms, came into the bay and picked up the personnel and equipment.

In the following summer Glen returned to Spitzbergen with two companions, hoping to finish off some surveying which had not been completed. Neither Lygon nor Waugh, his companions, had ever been on a sledge journey before, and conditions proved to be about as bad as possible. Their goal was the inland ice, and the route led up the Ebba Glacier, with its blue cascades of ice and green crevasses. For three days they waded through slush, which plastered their skis and made a march of three miles a ten-hour battle. Finally, after a week's fine weather had caused a general thaw, they decided to abandon the effort to cross the ice-cap. Hoping to pick up a boat which had been left there, and with which they could explore the valleys and glaciers on both sides of Wijde Bay, they made for the coast. Their base was to be an abandoned hut.

On the way down to the coast the sledge showed such imminent signs of breaking up that they dumped most of the provisions, and pushed on with only sleeping-bags and a couple of days' food. The hut was reached safely, although there was no sign of the boat; and next morning Lygon and Glen set off to pick up the stores from the sledge. They had not gone far when they found the way blocked by a glacier stream which had been a mere trickle before, but which now was a roaring torrent, hurtling down great blocks of ice. After following the bank of the stream for some way they came to a place where the water was shallower. Lygon started to cross, and after going two yards disappeared. He came to the surface, and began swimming for the other side. He reached the shore about sixty yards from where he had started, and, clambering out, took off his clothes and wrung the water out. When he had dressed again Lygon went off to the depot, while Glen went back to the hut for Waugh and some strong twine. Lygon came back with his rucksack filled with food. A ski stick was thrown over to him with the twine attached. Lygon tied himself on, and was pulled over.

By this time yet another glacier stream had formed and so had to be crossed on the way back, and in the middle of this Waugh was knocked over by an ice-boulder, the sudden jerk on the life-line pulling Lygon over too. Then the rope broke, and Waugh was able to scramble ashore a few yards away; but Lygon was driven by the rapid current towards the mouth of the river. Eventually he came to a stop against a stranded ice-boulder, and as his hands were completely frozen it was only with great difficulty that he was able to pull himself to his feet and so make his way to safety.

For the next three days they nursed their bruises, and, since they could not find the boat, decided to make their way back over the glaciers to the base. As they had no crampons or axes they had to risk a frost, which would have made the ice-slopes unclimbable; but by this time their luck had turned, and they were able to make good progress back to the base and safety.

19

THE OXFORD NORTH-EAST LAND EXPEDITION 1935–36

THIS EXPEDITION, under the leadership of A. R. Glen, was one of the most ambitious of the ventures undertaken by the Oxford Exploration Club, and was also one of the most successful. Thanks to the efforts made by Binney and others, a large area of North-east Land had been surveyed, but there still remained large stretches—particularly on the north coast—about which very little was known. Glen proposed to survey the whole of this coast, and if possible to fill in the remaining gaps in the map of the other coastlines. In addition, a comprehensive scientific programme was drawn up.

In order to carry out this work it was decided that a whole year should be spent, and that one or two stations should be set up on the ice-cap. From the base investigations connected with the ionosphere, wireless telegraphy, meteorology, and the aurora were to be completed. From a photographic record of radio impulses it was hoped that a solution would be found to some of the problems connected with the 'Heaviside layer.'

They hoped to discover why it is impossible at certain times to get wireless signals in the Arctic. In addition, the ice-cap stations would measure the amount of snow and investigate the composition of the ice-cap.

The base hut was set up at the entrance to Brandy Bay, on the north coast of the island. It was thirty feet long and twenty feet wide, and had double walls which enclosed an air-space for insulation against the cold. Attached to it was the engine-room, which housed a small Petter generating unit and an Austin Seven engine for use with the transmitter. The engines stood up to the climate well, though in very cold weather it was necessary to keep them running continuously day and night for lengthy periods. There were also two small houses for the dogs.

On August 22 the expedition ship left Brandy Bay, and by that time the work had begun. Indeed by the end of that month a boat party had completed the survey of the north coast as far as Rijps Bay, which is roughly half-way to the most easterly point. The surveyors found clear evidence that in many places the ice was melting away *in situ*, while in some old glacier valleys there was already a covering of scrubby grass and saxifrages. Then the weather grew worse, and at length they had to run for home in the lee of the incoming pack-ice. At one point the sea was so heavy that their outboard motor was put out of action, and it was only after a long struggle that they were able to find shelter in a protected bay. The next day they continued the homeward journey using oars and sails.

Meanwhile, various sledge journeys had been made to establish the two ice-cap stations, this work being completed by early October. Another sledging-party then went off to set up a dump at the most easterly cape for use in the following spring. Blizzards delayed their progress, however, and it was early in November when they at last reached this strategic point. They had a narrow escape from disaster in a maze of crevasses lying to the south of the cape, but at last found their way down to the sea; and the depot was established in a small bay. Just as they were about to start on the return trip a polar bear suddenly appeared. The bear was very inquisitive, and slowly ambled towards the sledge. The dogs were wildly excited, but Croft—the second-in-command—whipped them back and so prevented a fight which might have jeopardized the party's chances of returning safely. There was no rifle available, but Croft's companion, Wright, armed himself with an ice-axe and made ready to do battle. The bear showed signs of fight, but the menacing sweeps of Wright's ice-axe plus a barrage of shouts proved too much for him, and he made a hurried departure. Later on the members of the expedition saw several more polar bears. Murchison Bay, where the two biologists set up their hut, was much frequented by bears. One bear often slept in a snowdrift about sixty yards away. She was christened Emma and her two cubs Rupert and Olivia; and the explorers spent many happy hours behind icebergs watching the cubs clambering to the top of an iceberg and sliding down on their tummies

like lively small boys. Meanwhile, the mother seemed to enjoy throwing lumps of ice two or three feet over her head.

In order to make the ice-cap stations habitable during blizzards or excessively cold spells it was decided to use the same method as employed at Little America by Byrd and by Wegener at Mid-ice, that is to dig a deep pit and to live in the ice rather than on it. An Arctic tent with an umbrella-shaped top was set up in a hole fifteen feet in diameter. The floor was a double thickness of wooden planking, and in the middle was a trap-door leading to a tunnel excavated in the ice beneath. For this work small chisels were used, and eventually a tunnel five feet high and three feet wide was made. There was a separate entrance shaft, with a wooden tower made of empty packing-cases; and caverns were excavated in the tunnel walls for various purposes. One side-passage fifty feet long led to a safety cavern for use in the event of any disaster destroying the tent. There was also a larder which had all the advantages of the most modern refrigerators. Later on the tunnel was still farther extended, and eventually they came to a crevasse which widened with depth, and at the bottom of a cavern some seventy feet below the surface there was a lake of still water which remained unfrozen for almost the whole of the year. In the intervals between their icy burrowings the inmates of the station kept their vigil at the meteorological instruments, and were in regular radio communication with the base. Glen himself spent five months in the northern ice-cap station, which was constructed along similar lines to the central station.

With the return of spring the survey programme began in earnest. Croft and Glen made a journey across the sea-ice to the north of the island, but had to turn back when they were fifty miles out owing to the chaotic ice conditions and the fact that one of the sledges was broken. They then made a journey from the base across to the east coast and then to the south coast, thus completing the survey of the whole coast of North-east Land.

Meanwhile two other surveyors had been planning the north coast in considerable detail. At one point they came across an old camp site with several boxes and old tins littered about. In one of the boxes they found some Italian documents and some

balloon cloth, and they wondered if these were relics of the Nobile airship disaster, of 1928. This party took with them a sledge which could be converted into a boat for use in open water. The hull was made with a double-size ground-sheet of special canvas, the bow was made with a rucksack, rowlocks were improvised from ski-sticks, and for oars they tied ice-axes on to the end of their skis. On one occasion this boat carried a man with five hundred pounds of food and equipment in a choppy sea. On another occasion the two northern surveyors found it useful for transferring their kit across Rijps Bay. On the way back Wright, who was the navigator on this trip, found the wind was beginning to rise, and when he rejoined his companion he found the ice-edge was rapidly breaking up. Suddenly the floe which they had used as a landing-stage broke adrift and began to go out to sea. They jumped into the boat, but found it impossible to row since they had to concentrate on bailing to keep the craft afloat. The dogs meanwhile were afloat on the ice-floe. Fortunately, all ended well since both the boat and the floe drifted eventually on to the shore at the head of the bay.

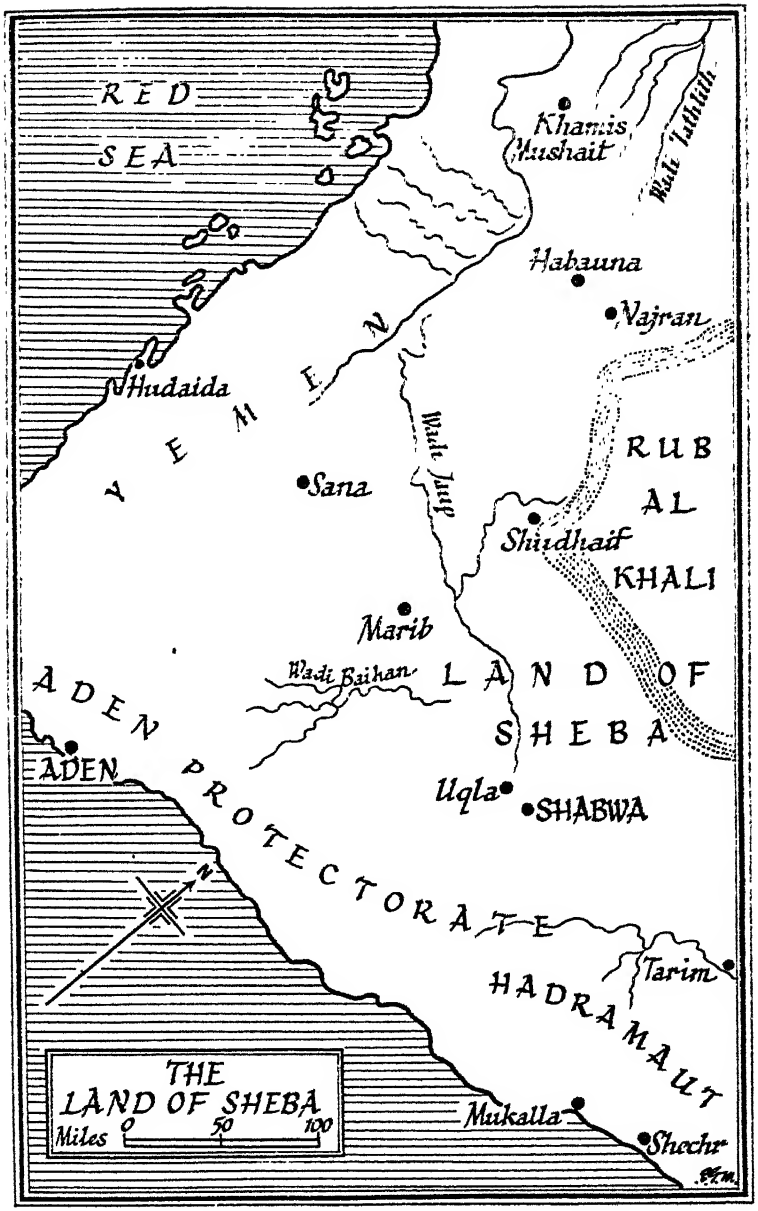
Ultimately the whole of the north coastline was surveyed, and the parties returned to the base, rejoicing in the knowledge that at last the final mysteries of the geography of North-east Land had been revealed.

20

EXPLORING THE LAND OF SHEBA

THE STORIES of Bilqis, Queen of Sheba, of the Land of Ophir and of King Solomon's Mines, have aroused the interest and speculation of historians and travellers for centuries. Various theories as to the location of these romantic places have been put forward, but it is now generally agreed that the solution to the age-old problem lies in Southern Arabia. Both Thomas and Philby claim to have located Ophir in the vast desert called the Rub al Khali (although they suggest different spots), and for some years it has been maintained that the Queen of Sheba's capital was at Marib, in the heart of Yemen. Here there is a pile of massive ruins and evidence that in ancient times there was a great irrigation dam here, which may account for the stories of the great fertility of the kingdom of Bilqis. Nevertheless, travellers in the Hadramaut were often told of a mysterious town called Shabwa, somewhere in the interior, where there were still preserved the relics of a glorious empire. The problem was whether Shabwa and Sheba were identical or not.

The first explorer to throw light on this problem was a young German, Hans Helfritz, who in 1935 joined a caravan at Shechr, on the Indian Ocean, and made his way to Tarim, in the Wadi Hadramaut—that great channel which is such a striking feature of the geography of South Arabia. Shabwa lay off the beaten track far to the west, and so at Tarim Helfritz had to organize his own expedition. He sought to collect a number of Bedouin who lived near the unknown city, and was lucky enough to find a salt merchant, who agreed to accompany him. The next day the merchant had collected together his fellow-tribesmen, and off they started. Helfritz soon realized that the journey was not to be too easy, since at the first place they came to they found that Bedouin were besieging the village; they could hear a battle raging round one of the precious water-holes. Avoiding the scene of the battle, the caravan passed on, but a few minutes later a handsome but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very wild-looking Bedouin suddenly appeared from behind a dune, and demanded toll. Ambarak, one of the Bedouin in the explorer's caravan, took this demand as a personal insult, and after a great deal of furious argument a private duel, complete with rifle fire, developed. The caravan passed on, and soon the Bedouin was seen to be running away.

At length, after marching ten or twelve hours for three days, the caravan approached Shabwa. Near the mouth of a wadi some Bedouin children were encountered. They told the explorer that on the conical mountain near by inscriptions were to be seen. This was just the sort of clue that Helfritz had been hoping for, and, turning aside, he climbed the hill. He found an old well there, and then some old Sabæic inscriptions on the ruins of an ancient city.

Now that Shabwa was so near a good deal of cunning had to be used. Helfritz knew that the inhabitants of the 'lost city' would never allow a stranger to enter. They believe that immense riches are hidden beneath the ruins, and fear that a stranger might steal them. It was decided, therefore, to creep into the city at dead of night. As they approached not a soul could be seen, and then quite suddenly the ruins of a wall appeared, some fortifications, and a mosque with a conical roof. Carefully the invaders climbed up the hill, and found their way almost noiselessly into the heart of the town, where there was a rest-house of which the salt merchant possessed the key.

Helfritz was shown into a heavily shuttered room, and the door was quickly shut and bolted. Although everything was so quiet, he well knew that if the excitable natives heard of the presence of a stranger they would at once threaten him with death. Ambarak too knew this, and so during the night he went off to his near-by tribesmen, and at break of day eleven of his brethren came clattering into Shabwa and entered Helfritz's room. The advent of these reinforcements at once aroused the attention of the people of Shabwa, and before long the local sheik and a great crowd of Bedouin had forced their way into the rest-house. As it was still dark Helfritz was not noticed for a time, but eventually one of the townsmen approached closely, tore off his kufiya, and cried, " Frengi, Frengi. A stranger has invaded our city! "

There was an immediate outcry, and a great babbling of voices, but the natives did not seem to be able to make up their minds what to do. One of Helfritz's men proceeded to prepare a delicious meal for their entertainment, and, taking advantage of this ruse, the explorer managed to slip out with his camera. He was accompanied by three armed men. He found that the town was built on three hills, each of them being a heap of ruins with mighty squared stones partly covered by the sand. Interspersed among and above the ruins were the miserable mud huts of the jealous population.

Arriving at the top of one of the hills Helfritz was pelted by the women, who came out of their houses to insult the stranger who had come to rob them. The boys were more friendly, however, but even they would not reveal the inscribed stones which he wished to photograph, and which according to rumour existed in large numbers. Hurrying on, the little party reached the second hill, so far having made no important discovery. In feverish haste, and always taking photographs, Helfritz began to look for himself. Suddenly he came upon a big squat stone in which the old Sabæic letters were chiselled, but which at the moment served as the threshold to a filthy goat's pen. But there was no time to delay. All round came the noise of the excited natives, and they dashed on to the third hill. There he had his reward, for in a little depression he could see the beautiful ruins of the ancient Palace of Kings, the gigantic walls of which showed clearly above the sand and boulders.

By this time three Shabwa men were running excitedly towards them; but Helfritz rushed into the ruins, took a few snaps, and then, running round in a different direction, avoided the three Shabwas and went back to the rest-house. Here everything was in a state of confusion. Having eaten all the rice provided, the natives were hinting that the time had come to kill the invader. Hastily all the belongings of the expedition were packed into the saddle-bags, and Helfritz and his men went out.

By this time Ambarak and his stalwart tribesmen had begun to fight with the assembled Shabwas. Shots were being fired; but in the turmoil it was impossible to distinguish friend from foe. A very confused battle resulted, but the snipers on the roofs

of the houses were either bad marksmen or else frightened of hitting their own men, since Helfritz and two of the men were able to get the camels out of the city without loss. Bullets whizzed past their ears and splashed the sand into their faces; but the Bedouin were fighting a brilliant rear-guard action, and the expedition came through unscathed. About two miles from the walls the camels were halted to await the escort, who eventually arrived safe and sound.

Once in the hills Helfritz thought he would be safe, but here too his party had a skirmish with a troop of bandits, and it was not until he reached the wadi Irma that the route could be called easy. Eventually he arrived back at Shechr. He had penetrated into the secret city, but had not really solved the old problem: that was to be reserved for some expedition better-armed and better-equipped than his own.

PHILBY IN SHEBA

In December of that same year 1935 H. St John Philby, one of the greatest of Arabian explorers, was in Riyadh, the Arab capital, making arrangements for a great journey from the north to the south of Arabia. By a coincidence, at that very moment the President of the Royal Geographical Society made a speech in which he said " a journey from Mukalla right along the hinterland, through the western confines of the Great Arabian Desert to Taif (near Mecca) would be a very fine piece of travel, about the only piece of the Arabian peninsula that is entirely unexplored." This was precisely the journey that Philby proposed to accomplish, and, in addition, he hoped to explore a great deal of the mysterious Land of Sheba.

Philby set off from Ashaira, near Mecca, in May 1936. He had three motor-cars and seven or eight companions. For the first part of the journey he followed the ancient " Road of the Elephant," the road which must have been followed by the Queen of Sheba when she travelled to the court of Solomon. Philby drove across the great lava-field south of Mecca to the three valleys of the Jebel Tathlith.

Crossing many wadis—one of which was in flood owing to a sudden storm—he came to the twin market towns of the desert, Raushan and Nimran. Here the Bedouin of the desert

mingled with the oasis people and the folk from the mountains to buy spices, dates, coffee, leather goods, arms, and ammunition. Only one European had previously visited this oasis; and for the next two hundred miles southward as far as Najran the country was quite unexplored.

Philby found there were several oases—some of them many miles in extent. At Khamis Mushait the wadi ran in a broad, flat channel, with extensive corn-lands on either side and more than a score of villages. The houses there were made of clay and cleverly decorated with geometric patterns in a variety of colours; and the natives made excellent wheat bread. The price of a bride was, however, rather low—about one pound in our money.

Striking eastward from the Tathlith valley, Philby's expedition now followed the western edge of the great desert of South Arabia. He found that the sandstone rocks bore hundreds of inscriptions which depicted an ancient community devoted to hunting and fighting with long lances and cross-bows. There also were pictures of horses, although according to ancient tradition the Shebans had no horses. There was also evidence that in ancient times the natives had erected astral monuments, after the fashion of Stonehenge.

Having explored the wadi Habauna, Philby sought out an ancient pilgrim route of pre-Islamic times. It was said that at Najran there was a Kaba like the famous one at Mecca, but that it had been forgotten and lost. On a long, isolated ridge Philby soon came upon some interesting clues. He found four large cemeteries, with quite elaborate tombs richly inscribed with ancient writings. It became clear that this was the old pilgrim route when some old cisterns capable of supplying a large multitude were found. A little way beyond this he found a pathway, partly paved, and still clearly marked, which ran in a semi-circle around a great block of basalt rock. There could be little doubt that this rock was the ancient Kaba of the old astral cult, and that the path resembled the famous circular way around which pilgrims walk when they make the holy pilgrimage to Mecca.

At Najran itself, on the northern boundary of Yemen, there were many miles of palm-groves, large cornfields, and even

small areas where there were swamps and ponds. Yet the houses of the population of about 10,000 were widely scattered, and could hardly be called villages. The reason for this is not far to seek. Until the last few years Najran has been famous for its vendettas. Every man's hand was against his neighbour, who was usually conveniently situated in easy musket range. Yet there were ample signs that at one time Najran had been unrivalled as a centre of Arabic civilization. The beautiful valley was littered with the remnants of temples and other buildings, and Philby was able to gather a large number of inscriptions. Najran was the see of a Christian bishop up to about a thousand years ago, and there is still a large Jewish community in the district.

From Najran Philby made a journey along the frontier of Yemen. This took him into very different country, where towards the coast there were great parks of forest-trees, many flowing streams, and many people. Then he turned southward, and made a thorough exploration of the land of Sheba. No cars had yet ventured into this district, and Philby knew that there would be great obstacles to be overcome. In addition to the two cars, therefore, he had a caravan of twenty-four Arabs including some from the tribes he expected to meet on the way. The first part of the journey across the desert to Shabwa would be the worst.

Skirting the dreaded Rub al Khali desert, the cars travelled steadily onward over sand-tracts, along rocky mountain valleys, for a week, until the wells of Shudhaif were reached. Then the expedition turned across the desert towards the Hadramaut—a distance of a hundred and fifty miles, which was expected to be very exhausting. Actually the going was good; over a vast plain of grit and gravel the cars made excellent progress, although the camels found the heat trying and took five days to reach the wells. To reach Shabwa they now had to cross a thirty-mile-wide belt of big sand dunes, and were caught by a violent sandstorm in the midst of the crossing. Philby drove into a deep sand-drift, and spent a miserable night there.

The next day the expedition arrived at Shabwa, and, knowing the reputation of the inhabitants, were a little alarmed at the sight of a large gathering of armed men awaiting them.

Actually these men were a guard of honour, and the chief made Philby welcome. Like Helfritz, Philby found Shabwa very disappointing at first. The wretched little village of clay and masonry gave little impression of the once mighty capital of the Himyarites. Not a single ancient building stood intact, not one pillar of the reported sixty temples stood upright; there was simply a jumble of debris littering a huge ruin-field.

Entering the ruins through the fallen remains of a gateway, Philby was followed by a huge crowd of the natives. They all seemed to think that in some way he would lead them to the fabled treasure, and scrutinized carefully every sherd he picked up. There was a great mass of fragmentary houses, and a long, straight road, which eventually led to Shabwa's greatest monument, the Temple of Astarte. There was not much left of the shrine above ground, but the column-bases of limestone could be seen, besides some steps and an inclined ramp. At the top of the ramp there had evidently been a colossal statue, and in ancient times the approach to the portals must have been very impressive. Three courses of well-trimmed blocks of masonry marked the northern wall for fifty-five feet, but little remained of the other walls.

All told, the ancient city covered an area of twenty-seven acres, and was a perfect rectangle. The site of the old palace could be traced; it seemed to be built in the same style as the Temple of Astarte, although most of the masonry had been incorporated in the miserable hamlet which squats on the site to-day. The palace apparently abutted on to a corridor giving access to the city. Just inside the gate there was evidence of some kind of temple or town hall partly built of marble. Elsewhere the ruins defied analysis, except along the flanks of the torrent-bed where there still stood the massive masonry of the embankment wall. In short, Philby came to the conclusion that Pliny's story of the sixty temples of Shabwa was a gross exaggeration, and that if there were any truth in the story at all it would apply not to the ancient capital but to the whole district of Sheba.

The explorer was more impressed by the ruins of the ancient irrigation system. The masonry of the main channels could still be traced for a considerable distance, and here and there he

found the remains of masonry sluices and extensive ruins of buildings. He also visited the nearby salt-mines, which may once have provided some of the wealth of Bilqis.

Journeying onward to the south, Philby visited various parts of the Hadramaut, afterwards making a traverse through a little-known area to the sea. Then he returned towards Shabwa and made several more discoveries in the land of Sheba. Near a spot called Uqla he found an immense area which must have been under cultivation when Sheba was prosperous. Here one of the Arabs pointed out a little rock which appeared to be crowned by a small building. On approaching Philby was amazed to see that the whole of the rock surface was covered with inscriptions—one of the most important finds so far. The building above was approached by a flight of steps, and seemed to be a military post intended to guard the fields which stretched to this point from Shabwa ten miles away.

Farther away he was able to find traces of the streams which had once flowed through the land of Sheba into the great Hadramaut valley. In places there was a profusion of fresh-water shells, and it seemed clear that once these streams had been harnessed to irrigate an immense plain and support a powerful empire.

One day Philby climbed a small hill in order to look for an oryx, and, to his astonishment, found that the hillock was roughly flat and circular, and that it was approached by a pathway hedged in with walls of sandstone. Looking around for an explanation, he noticed that the main ridge beyond was dotted with curious circular turrets, which turned out to be tombs. A few miles away he found hundreds of similar tombs—indeed, the whole hill-sides were littered with them, running in long lines and probably numbering many thousands. He realized that he stood in the midst of an immense necropolis, and yet it was far out in the desert and forty miles from the nearest well. The tombs were circular in shape and beautifully built of local limestone. In all cases the tombs seemed to have been opened and plundered by robbers; and Philby found few clues to solve the mystery of this ancient cemetery.

From other inscriptions found in the Sheban country experts say that there was undoubtedly contact with the Phœnicians.

Indeed, it has been suggested that the Land of Sheba was the original home of the Phœnicians, and that the Sheban inscriptions show the evolution of the alphabet from the older picture signs. The little rock at Uqla contained many references to Himyarite kings who ruled about the third century A.D., but many of the other inscriptions discovered were much older.

In view of the fact that in one part of the country there are the craters of old volcanoes and other signs of plutonic activity, Philby came to the conclusion that the vast system of irrigation works, the mighty temples, and the many myriads of buildings all over the great plain were destroyed in some great earthquake, and that possibly the great cemeteries are also to be related to some such calamity which overwhelmed the ancient land of Bilqis, Queen of Sheba.

Note. During the winter of 1938 Major R. A. Hamilton was able to undertake some preliminary excavations at Shabwa. He came to the conclusion that the site was the holy place of South Arabia and a burial-ground for the priests who worshipped the god Yafa. Is it possible that Yafa can be the Jehovah whom Solomon worshipped?

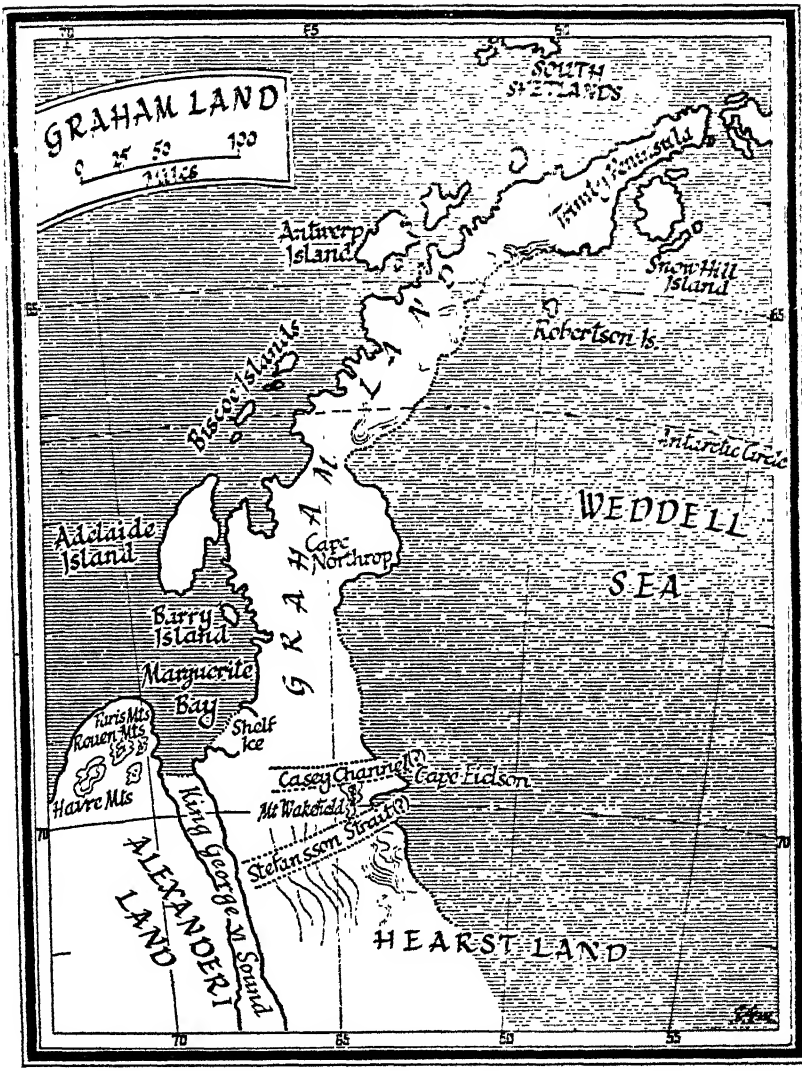
21

THE BRITISH GRAHAM LAND EXPEDITION

IT IS now more than a century since sealers and whalers, pushing southward from the Falkland Islands and South Georgia, vaguely reported landfalls, where lofty ice-covered mountains and gleaming white ice-cliffs fringed an inaccessible plateau. John Biscoe in 1832 named this land Graham Land in honour of the First Lord of the Admiralty. Later explorers discovered many islands in the neighbourhood of this long Antarctic peninsula; and in the years 1909 to 1910 Dr Charcot explored a long stretch of the western coast of Graham Land. He gave his own name to Charcot's Island, or Land, which, together with Alexander I Land, appeared to form part of the main continent.

Then in 1928 Sir Hubert Wilkins made the first flight over the central plateau of Graham Land, and found that it was nearly 8000 feet above sea-level. He also reported that in the far south there was a broad channel—the so-called Stefansson Strait—which appeared to cut Graham Land off from the Antarctic continent. During the next year Wilkins flew as far south as the coast of Charcot's Land, which he estimated to be about forty miles north of the continent. On November 24, 1935, Lincoln Ellsworth—the famous American aviator-explorer—took off from Dundee Island, and flew right across Antarctica to Little America on the Bay of Whales, following the east coast of the peninsula for the first six hundred miles of that sensational trip. Ellsworth also thought he recognized Stefansson Strait, but reported that it was only a few miles wide, and could not decide if it really joined the Weddell Sea to the Bellingshausen Sea.

The British Graham Land Expedition of 1934–37 had thus many intriguing problems to solve. John Rymill, the leader, who had been with Gino Watkins on both his Greenland expeditions, hoped that not only would it be possible to explore much of the remaining unknown western coastline but by sledging through the newly discovered Stefansson Strait to


GRAHAM LAND
0 25 50 100
Miles
SOUTH SHETLANDS
Trinity Peninsula
Antwerp Island
Snow Hill Island
Robertson Is.
Antarctic Circle
Biscoe Islands
GRAHAM L.
WEDDELL SEA
Adelaide Island
Cape Northrop
Barry Island
Marguerite Bay
Shelf Ice
Kuris Mts
Rouen Mts
Havre Mts
Casey Channel
Cape Eidson
Mt Wakefield
King George VI Sound
Stefansson Strait
ALEXANDER LAND
HEARST LAND
70
65
60
55

explore the unknown Antarctic coast of the mysterious Weddell Sea. This was the sea where Shackleton's *Endurance* had foundered in 1915. At the same time Rymill hoped to send another party to explore to the west behind Alexander I Land and Charcot's Island. So far no explorer had ever crossed Graham Land, and the field open to the expedition was therefore a very wide one.

On February 14, 1935, the expedition ship, the *Penola*, arrived at the Argentine Islands, off the coast of Graham Land. On the voyage a serious misfortune occurred which was destined to change the whole course of the expedition. It was discovered that the engines had shifted on their beds, and were out of line. For about nine hundred miles the *Penola* had been relying on sails, but it was clear that she was in no fit condition to reach the southern parts of Graham Land. Thus for the first winter a base had to be set up on the Argentine Islands.

The aeroplane was unpacked and assembled, and before the end of the month Hampton and Rymill had flown to a point one hundred and fifty miles to the south in search of a sledging route across the peninsula. For the whole distance, however, the high central plateau was guarded by a great rock cliff, which made sledging impossible. Nevertheless, during the next six months a good deal of surveying work was accomplished among the islands to the south of the base.

February 16, 1936, was the great day, when the *Penola* was able to set off for the south again. It was not easy work, since there was thick pack-ice around the islands; along the uncharted coasts it was necessary to 'feel' the way by sending a motor-boat ahead to make soundings. The aeroplane was very useful, because not only could it pick out anchorages but the pilot could also make sketch-maps of the dangerous sunken reefs.

One bright, sunny morning Rymill and Hampton went over to the little bay where the aeroplane was moored, feeling rather excited. They thought that at last they would see something of the unknown land beyond Charcot's farthest south. The brash ice was so thick along the shore that Hampton had to taxi about a mile before he could find a stretch of water clear enough for a take-off. It was a cloudless day, and as they rose they could

see the sun glinting on the steep glaciers of Alexander I Land, about eighty miles away. To their delight they saw that the floes in the great bay below them were loosely packed, and so the *Penola* would be able to advance. As they peered into the thin mists of the distant horizon they were suddenly thrilled to see a great chain of mountains some ninety miles ahead, which appeared to connect Alexander I Land to the main continent. But before they could make certain they had to circle round, as the aeroplane's petrol supply was limited. Moreover, they had reached the edge of the unbroken ice, and must look for a base, since this was to be 'journey's end' for the ship.

A few days later the southern base was established beside a crescent-shaped bay on a large island. The season was now well advanced, and the *Penola*, having landed the hut and provisions, set off for the north. That same day was fine, and so a fresh flight to the south was undertaken. This time it was made abundantly clear that all the existing theories about Graham Land were quite wrong. Although they had to limit the flight to two hours, they discovered that Casey Channel, which was supposed to cut Graham Land off from Antarctica, did not exist. They also saw that the wide bay south of the base had a great stretch of shelf-ice, and that the bay curved round to meet a newly discovered chain of mountains. The only sign of a break in the coastline was what appeared to be a narrow fiord just ahead. They were unable to see how far this fiord ran but they could see that it was bounded on the east side by sheer precipices. Beyond this extraordinary cleft there were long ranges of mountains, and they were puzzled as to where Stefansson Strait could be. Had they but known it they were looking at what was to prove the entry to the most astounding of their discoveries.

Meanwhile Lincoln Ellsworth had made his famous flight across Antarctica, and Rymill now received the news by wireless "Ellsworth confirms Stefansson Strait but says it is only three miles wide." Thus the mystery remained complete. Was Graham Land an island cut off from the mainland by a strait or was it merely a long peninsula, as their own flight seemed to indicate? Rymill decided to give up any idea of a long trip across Graham Land and concentrate on solving this problem.

During June an effort was made to lay a depot over the sea-ice in Marguerite Bay. In the thick, soft snow the tractor party broke a trail for the sledges to follow; but it was terribly slow going, and at times there were over 60 degrees of frost. The scenery was not without beauty. Here is an extract from J. Rymill's *Southern Lights* describing some of this beauty.

> When the sky cleared the clouds over the Graham Land mountains to the east remained dark, but took on lighter shades as they faded into long streamers towards the zenith, where their edges were touched with the reds and orange of the sunset light from the north. Down the western horizon the great mountain ranges of Alexander I Land stood out mysteriously, showing a pale copper colour against a dark grey haze into which they gradually disappeared farther south, while the soft winter twilight made the whole scene look coldly beautiful, but rather awe-inspiring. As we sledged along I was impressed by the thought that here was all this strange grandeur round us, and we—people of the twentieth century who had left an overcrowded land only a few months before—were the first to see it since the world began.

On the third day out a blizzard snowed the tractor up and delayed the start on the following morning. The next day another violent gale sprang up, and when they were carrying boxes from the sledges into the tents they had to lie down, using the box as an anchor at times. It was impossible to sleep, so they all lay down fully dressed, expecting that the sea-ice would break up at any moment. Then the wind dropped, and they had just settled down to sleep when the ice shuddered as if it had been struck by a mighty sledge-hammer. Rymill went out into the heavy snow, and found that the ice had broken up into large pans and that there was a two-foot crack outside the tent. A little distance away the floes were rafting on one another, and so it was decided to keep a watch all night long.

The next morning they climbed a small iceberg and saw that they would have to abandon the tractor and make with all speed for some small, rocky islands a few miles ahead. Luckily, the wind was moderate, and they were able to make good progress for about two miles. Then a wide lead held them up, and they had to turn in towards the mainland, eight miles away. Conditions got steadily worse, and pressure-ice forced them

round a group of large bergs which had caused a terrible ice-mess. Once round this obstacle they were able to steer for the islands again, though here and there the dogs had to swim across the leads. From time to time the sledges got jammed or tipped over in the knee-deep slush on the edge of a lead. The twilight began to fade. It was a race against time now. Could they reach the islands before the wind freshened and carried the whole party out to sea?

Now the islands looked fairly close, but it was getting unpleasantly dark. They were stopped by a lead several hundred feet wide. Things really did look serious now, since the side of the nearest island was made unclimbable by a vertical ice-cliff about eighty feet high, and in the darkness it seemed as if the wide lead would force them back to the icebergs they had just escaped from. Rymill went off to explore the edge of the lead by the light of a powerful torch, and as luck would have it found a possible crossing-place where the lead narrowed and where a loose ice-pan could be used as a raft. At last the lead was crossed, and then an hour's splashing about in the dark brought them to a low ice-tongue which gave access to Terra Firma Island.

Mid-winter's day found them marooned on Terra Firma, but four days later they were able to set off on the return journey across a confused jumble of ice-slabs. That night they camped on a large level floe, and reached the base safe and sound two days later.

During the next two months an important surveying journey was made along the coast to the north of the base, and preparations for the main journeys to the south were under way. There were two sledge parties. Stephenson, Fleming, and Bertram were to explore the mysterious rift valley, while Bingham and Rymill were to attempt a crossing of Southern Graham Land.

On August 15 Hampton and Rymill made a reconnaissance flight across the shelf-ice in the bay to the distant mountains. As they drew level with the ' narrow fiord,' or rift, they were surprised to see that it was both wider and longer than they had expected, but as their main objective was the north coast of Alexander I Land they had no opportunity of making a proper

investigation. Having photographed the north coast of the Land, they turned homeward, looking eagerly towards the fiord as they passed the last mountain. By this time the clouds had cleared, and they were able to see what appeared to be a great sound running away to the south as far as the eye could see. The mouth, which was sixty miles away, looked about fifteen miles wide.

Since this flight had shown that ice conditions north of Alexander I Land were bad the explorers now decided to concentrate on this new discovery. Two days later the plane flew down with provisions for a depot-laying party, but then followed several days when flying conditions were bad. On the next fine day Hampton flew the hundred miles to the great sound, and since the weather was clear they were able to get a better idea of its proportions. On the west side there rose a solid wall of mountains 8000 feet high, but on the east the land rose gently to about 4000 feet. They saw that open water would make it impossible to sledge into the mouth of the sound, but noticed one or two possible routes across the glaciers on the eastern wall. Shortage of petrol caused them to turn back when they had flown forty miles down the rift, but as far as they could see the long mountain ranges continued for many more miles, and there was still no sign of either ' Casey Channel ' or ' Stefansson Strait.'

At last the sledging-parties got away, passed Terra Firma Island, and on the seventh day reached the shelf-ice in the bay. Then followed eight days of wind, snow, and hopeless visibility; and eventually Rymill and Bingham had to hand over most of their supplies to the ' Sound ' party, and return themselves to the base to get fresh supplies. Stephenson found a way up from the shelf-ice on to a col, whence they hoped to sledge down into the sound. It was foggy, and they almost stumbled over a very steep drop. The next day was brilliantly clear, however, and they made a march of twenty-five miles to the edge of the sound.

Before them stretched the precipitous, ice-covered wall of the western coast, and the sight of this made them keen to start compiling their maps. But the ice in the sound was greatly disturbed by glaciers pushing into it; and there were huge rifts thirty feet deep to be crossed. It took three days to get clear of

the fifteen miles of bad ice; but once south of that the sledging conditions were good, and for the next few days they averaged over twenty miles, passing new country on either side. As each day went by fresh promontories loomed up on the east side—the side they were following—while to the west the 'last point' remained as far ahead as ever. Gradually the aspect of the western wall changed, and they now saw flat-topped hills. Then, to their surprise, they realized that the rocks on that side were sedimentary and stratified. Since Graham Land is made of igneous rocks like the Andes it became clear that the Sound was a major fault-plane—a gigantic crack in the earth's crust where there had been a vertical movement of several thousand feet.

At length Stephenson's party passed south of the mythical Stefansson Strait, and saw that just ahead of it the east shore began to curve round in front of them. From this point the Sound seemed to continue for at least another fifty miles and widen considerably; but as their supplies were now getting low they had reluctantly to begin the return trip of three hundred miles without exploring farther. A glance at the map at page 185 will reveal how radically their journey had amended the previous conceptions about this section of Antarctica.

On the way back the party set foot on Alexander I Land, a part never previously visited by man, and which had proved to be at least three hundred miles long. They took the opportunity to make certain that the rocks on this western shore of the Sound were sedimentary, at the same time making a collection of fossils. Some of the shales were filled with plant remains, and it may be that there are coal-fields as yet unknown in that region. The return trip was not without its adventures too: at one point Stephenson and Bertram fell thirty feet down a rift, but fortunately landed in a bed of soft snow. Rations were short, and they had to kill off seven of the weakest dogs to make the dog-food last out until they reached a depot on Terra Firma Island.

Meanwhile Rymill had flown down the Sound, and, realizing that it was far longer than he had guessed, decided to go eastward from the col near the entrance to the great cleft. Near this point Rymill and Bingham met the returning Sound party, and

exchanged news. The leader and his sturdy companion then turned eastward off the trail, and climbed steadily on to the great icy plateau. The surface was so soft that they had to resort to relaying half-loads. There was, of course, some danger in this proceeding during snowstorms, but their aeroplane compasses were so steady that they did not lose one another.

A week's hard work brought them to the top of the last ridge at 6000 feet. From there they could see ahead a high rocky pyramid peak and a new range of mountains silhouetted against the evening light. For the next few days they trudged along towards a pass near the pyramid peak. On pitching their highest camp at 7500 feet, they found that the great peak, named Mount Wakefield, was 2000 feet higher still. From this high point they had hoped to be able to look down into the Weddell Sea, but they were surprised to find yet another plateau stretching away for another twenty or thirty miles to the east and then, in the far distance, yet another mountain range.

The dogs raced across the plateau, and the next day found the lone explorers twisting and turning in the coastal ranges. But presently they were held up by badly crevassed glaciers and had to turn in their tracks. Bingham lost his leading dog in one hole, while another fell out of his harness on to a ledge about thirty feet down. Rymill lassoed the dog with a climbing rope, and dragged him up by the neck, apparently without any ill-effects! For three days they had to lie up because of gales, but at length they reached a high point from which they had a clear view to the south and east. Christmas Day found them still struggling to find a way through the range down to the sea. The task eventually proved impossible, but they managed to make a map of the Weddell Sea coastline, which ran north-south for about fifty miles and then swung out to form a mountainous point about sixty miles away. Then they began the return journey; good going enabled them to cover fifty-four miles in two days and soon they were looking down into Marguerite Bay.

The following is an extract from *Southern Lights*, by J. Rymill:

> We were still 130 miles from home, but the first sight of well-known landmarks and the sea gave us a pleasant sensation of familiarity, which was a relief after the austere country through

> which we had been travelling for the last forty-five days: a country which had known eternal peace until we, two puny little black dots in its vastness, had the impudence to lift the curtain for a few brief days and look upon its beauty. . . . Day after day we had travelled through silence which was absolute, not a depressing silence as of the dead, but a silence that had never known life. Even more impressive had been the sheer immensity of the country, and the atmosphere of mystery which seemed to dwarf us.

On January 2, 1937, Rymill and Bingham negotiated the final tide-crack and scrambled up the rocks to the base. They had completed a journey of 535 miles in 72 days and, besides exploring a huge area of new country, had made the first crossing of Graham Land.

22

THE VOYAGES OF R.R.S. "DISCOVERY II"

WHILE THE exploration of the land surfaces of the globe has now been largely completed, there is still much to be learned about the oceans. For some years the important work of investigating ocean deeps and ocean currents has been carried on by the Royal Research Ships *Discovery II* and *William Scoresby*. Most of the recent work has been concerned with the Antarctic, where important investigations in connexion with the whaling industry have been undertaken. In addition to the marking of whales and the research into marine biology, a good deal of survey work has been done, and numerous alterations in the map of the Antarctic are due to the scientists of the various expeditions.

Perhaps the most interesting of the voyages of the *Discovery II* was the fourth commission, which lasted from October 1935 to May 1937. Important discoveries were made about the region, where the warm currents from the tropics mingle with the cold currents from the Antarctic, and about the small prawn-like krill on which whales feed. But hardly had the expedition got under way when there came an exciting diversion. On December 4, when the *Discovery* was nosing her way along the ice-edge, a telegram came ordering the ship to go to Melbourne so that she could be fitted out to assist in the search for Lincoln Ellsworth.

Ellsworth had already made a great reputation as an explorer in the Arctic, but this time he had undertaken his most ambitious project. Accompanied by a Canadian pilot, Hollick-Kenyon, he had set off from Dundee Island, in the north of Graham Land, in an effort to fly to Byrd's old base on the Bay of Whales, called Little America. It was from Little America that Byrd had flown to the South Pole in 1929, and Ellsworth knew that there were still plenty of stores left at that very interesting collection of huts and ice-caverns. It had been arranged that Ellsworth's ship, the *Wyatt Earp*, should pick

up the explorers after their flight across the great frozen continent.

Unfortunately, something seemed to have gone wrong. For a few hours the aviators kept in touch with their ship by wireless, and then came a sudden ominous silence. For some days the world's Press kept its readers in a state of anxious suspense. It was then that the Australian Government asked if the *Discovery II* could be sent to assist in the search. The response was so swift that within three weeks of receiving the message the research ship was sailing from Melbourne *en route* for the Bay of Whales, with two aeroplanes, seven airmen, and three months' stores on board. The ship was heavily laden, but the huge deck cargo had been so efficiently stowed that no damage was done in the fierce easterly gales. On January 6 pack-ice was encountered; but good progress was made through the leads until January 10, when enormous floes—standing ten feet out of the water—blocked the way. The *Discovery II* drifted northward for many hours, while the Moth aeroplane was sent off to look for promising leads. This plan proved so successful that open water was eventually reached four days later, the ship having passed through a four-hundred-mile belt of ice in a total of seven and a half days.

The next day the famous Ross Barrier was sighted. The scientists, on reaching the Bay of Whales, were delighted to see a tent pitched on the top of the ice-cliffs on the east side of the bay. The plane was launched; and before long the welcome news came that the missing aviators were quite safe. On the next day a landing-party went ashore, and found that Ellsworth and Kenyon had been living in comparative comfort at Little America. They explained that the flight across Antarctica had been accomplished in a series of five hops, which had brought them within sixteen miles of Byrd's old base. Then their fuel had given out, and they had been obliged to sledge in to Little America, where they had been since December 15. They had sighted the Hollick-Kenyon Plateau, in the middle of the continent, and several new mountains had been charted.

Soon afterwards the *Wyatt Earp* appeared, but the *Discovery II* had the honour of transporting Ellsworth to Australia before

she returned to her research work in the Antarctic south of Australia.

During the first two months of 1937 the *Discovery II* was engaged in survey work around the uncharted coasts of the South Shetlands. These islands, unlike their northern namesakes, are a nightmare to the navigator. All around the fog-enshrouded coasts myriads of needle-pointed rocks fringe the grounded icebergs like a natural *cheval de frise*. Since there were few channels in which the research ship could anchor safely, it was decided that the work of surveying could best be carried out by establishing base camps on land. A motor-boat provisioned for a few days was to operate from these base camps, and so complete the survey. An old, crude-oil motor-boat, called the *Rapid*, was obtained from a Norwegian whaling station as their own boats were unsuitable.

On one occasion Ommanney, the biologist, and five others set off in the *Rapid* to survey a huge, ice-encompassed gulf on the north side of King George Island, while the mother ship went to the south side for a week. However, the *Discovery II* was held up by gales, and it was nine days before she could get back to the camp on Esther Harbour. To everybody's consternation the camp was derelict except for sea-elephants and penguins: the party of six men had disappeared.

Apparently the small party had set off from the base camp and had, as was revealed later, anchored off the second point westward off a shingle beach. A party rowed ashore in the 'pram'—a small boat, in navy slang—to fetch fresh water and to collect specimens. When they returned, however, George, the engineer, found that he could not persuade the *Rapid*'s motor to start. For the rest of the afternoon he tried all the tricks he could think of, but at length Walker, the Chief Officer, wriggled into the cubby-hole of a cabin and announced, "It looks as though we're here for the night, so we may as well make the best of it." Luckily, they had brought along some of their provisions from the base camp, seven miles away to the east, and they set about preparing a meal in the swaying cabin. The situation was, nevertheless, quite serious. They were anchored a few hundred yards from a rocky, surf-girdled beach,

and the wind and swell were rapidly increasing. The tide too was sweeping out large fragments of ice from the glacier, and it was likely that the *Rapid* would soon be surrounded and possibly holed.

After a meal of hash George went back to the engine, but hour after hour passed without result. The cabin party were very sea-sick, for the swell was still rising. Some of them slept a little, and when they woke they found that the boat was being battered by ice fragments. They tried to push away some of the more menacing battering-rams with oars, but it was a hopeless task, since they had to clutch the rail in order to avoid being thrown overboard.

Dawn came, and the three men in the engine-room had been working for over twelve hours. Still there was no sign of life in the motor. Fortunately, the swell lessened, but it was not until the morning of the third day that the *Rapid* suddenly spluttered into activity. By this time the whole party were nearly exhausted from the never-ending pumping of compressed air into the cylinder. Now at last they had the victory. Everybody cheered and promptly began to plan to have a huge meal of seal-meat when they reached camp.

The *Rapid* churned steadily ahead until they were alongside a huge glacier which filled the seaward view. The engine stammered.

"Keep her going, George," cried Walker. "Whatever you do, keep her going just here!"

But in spite of George's tender ministrations, the *Rapid* stopped. This was desperate. The iceberg was already almost broken in half, and there was every possibility of a monstrous chunk breaking off at any moment and swamping the little boat. Every now and again there was a dull boom as a tottering pinnacle collapsed into the sea. They drifted so close that they could see every detail of the icy castle. The bo'sun's mate got into the 'pram,' and slowly towed the *Rapid* clear while the rest stood ready with boat-hooks to fend her off if she came within reach of the glacier. Slowly the iceberg drew astern, and at last it was possible to anchor about a mile away from the beach they had learned to hate during the last three days.

"We'll just have to stick it out and wait till the ship comes

back," said Walker, when George confessed that the confounded engine had beaten him.

It was icy cold that night: the men huddled together in the tiny cabin trying to keep warm. Towards morning Ommanney woke up to find that there was a great deal of water swishing about in the bilges. The *Rapid* had suffered a good deal from the battering of the ice fragments two nights before, and now it was necessary to work the bilge pumps for hour after hour.

For another day and night the crew fought to start the engine again, and since there was a full gale blowing it was useless to attempt to pull back to camp in the little 'pram.' The weather grew worse, and a hideous pall of flying snow half obliterated the grinding ice-floes. The *Rapid* was tossed about so much that the six hungry and weary men lurched on top of one another or lay in clinging heaps on the cabin benches. Black tongues of bilge water spurted through the floor-boards, and it seemed unlikely that the boat could survive. Finally, the bo'sun's mate said, "We'll have to beach her. It's our only chance. She won't ride it out, and the ship'll not be coming in this."

Then quite suddenly the engine decided to start again, and they were able to veer away from the welter of ice-blocks before the brute gave out again. On the fifth morning the sea was still enormous, and giant swells flung the boat about like a cork. Food-supplies were running short: during the last twenty-four hours the men had had only one biscuit spread with meat extract and one cup of tea. Though they still baled ceaselessly, the water was slowly gaining on them, and the engine was still cold and silent. Finally it was decided to attempt a landing in the 'pram,' and all the remaining supplies (including even crumbs of biscuit out of some boots) were gathered together and loaded in the little boat. Three men went on the first trip. They found it difficult enough even to jump into the 'pram,' since the enormous swell constantly drove the two boats together and then apart again. They made for a point where there was a gap in the reefs and fewer chunks of charging ice. Steadily they battled on through the surf, and at last reached the shingle. The gear was flung out, the bo'sun's mate then rowing back for the others. So the *Rapid*

was left to fight out the battle on her own, a mile out to sea. Two days later she was finally overwhelmed in a gale.

As the tide receded it left on the shingle a row of ice-blocks. With these the men made a sort of igloo by tilting the 'pram' up on her gunwale with large boulders. The open side was closed by an ice-wall, cemented with snow so that it arched over to meet the curve of the boat. At one end a tiny hole was left for a door, through which they could just wriggle on their stomachs. Lots were drawn for the two sleeping-bags, and the unlucky two had to make do with soaking wet duffel coats. But the ice-wall dripped relentlessly all night, and it was so cold that every now and again one of the men would get up to stamp about on the shingle and restore some life to his half-frozen limbs.

Fortunately, the next day was calm and sunny, so they carefully dried their clothes for the first time in a week. Finally, they decided to build a better house; and the two sleeping-bags were sewn together to make one big enough for four. This time the boat was turned completely upside down and banked round with shingle, and for once in a while they had a moderately comfortable night.

Early next morning they heard faintly the far-off hoot of the ship's siren, and when the fog lifted there, sure enough, hull down on the horizon, they could see the *Discovery II*. For a short time hopes ran high, but at last they realized that they had not been spotted, and to complete their disappointment giant icebergs slowly floated across the bay until they stood in a line completely cutting off all view of the ship. Then the fog came down again, and they knew that they would have to inhabit the shingle beach for at least one more night.

There was no danger of starvation. Sleepy elephant seals would drag themselves on to the shingle and lie in clumsy heaps ready for slaughter. Even when a seal was killed its slothful neighbours a few yards away would take not the slightest notice, and as soon as the fuss was over would roll over to resume their sleep. There were penguins too, which could be easily caught. Best of all, the castaways now had plenty of blubber with which to keep a fire going, although

the acrid smoke filled the shelter with sooty fumes. The blood of penguins was also used to dye a square of canvas for a distress signal, which was set up on a shoulder of rock with a snow-slope background to show it up.

Once again a fine driving rain soaked them through before they turned in, and after a miserable night they were suddenly awakened by the man on watch yelling, "Rouse out, lads! The sea will be here in a moment!"

So once again it was necessary to move the shelter to a place higher up the beach. In the streaming downpour they banked the stones round again, and then tried to make themselves comfortable on the wet stones inside. The next night the wind changed, and it began to snow: an icy blast, laden with powdered snow, drove straight in the doorway and blew the blubber fire out frequently. In the morning a snow-wall was built across the entrance, but the miserable inmates rarely ventured out except to drive away the Stinker petrels which were stealing their stores of seal-meat and blubber.

It snowed for thirty-six hours; but when the fog rolled away a sailing-ship was sighted. The ship, whose masts and rigging were clearly etched against the horizon, seemed to be making inshore.

They decided that the strange craft must be the *Penola*, a schooner attached to the British Graham Land Expedition. The *Penola* had picked up a message announcing the disappearance of the *Rapid*, and had joined in the search. The castaways capered about the snow-slope, and lit fires of penguin carcasses in an effort to attract attention, until with a sick despair they saw the ship turn away to port and sail away. Their antics had been mistaken for those of penguins!

Then came another surprise. A cruiser, the *Ajax*, which had been on a visit to South Georgia had also joined the search, and now she too loomed over the horizon. A little later the *Discovery II* also appeared, and all three ships came close together for a conference. Then they separated, the *Ajax* steaming off past the beach into the distance. The *Discovery II* still stayed in the bay, and some of the men wanted to try to row out to her, but it was decided not to take this desperate chance until the morning arrived.

Dawn came, and the parent ship was seen to be heading inshore. Once again they ran about the snow-slope, waving improvised flags and banners, and arranged themselves in geometrical patterns along the mountain-side. George loaded the brazier with moss and poured on it the last of their fuel-oil. Puffs of black smoke curled up the slope, and at last an answering signal came from the ship. They saw the whaler pull away from her side and make for the reefs; and, thankful that their chilly vigil was at length ended, they loaded up the 'pram' and rowed out to meet their ship-mates.

23

RECENT EVEREST EXPEDITIONS

THE POLAR regions have been explored, the hidden secrets of the burning deserts and the gloomy forests revealed, but Everest remains unconquered, the supreme test of courage and skill. But the struggle goes on. Since the first expedition in 1922 no less than eight heroic climbers have reached the great couloir which sweeps down from the final pyramid of Everest. This chosen band have all struggled with the fierce Himalayan blizzards and the mental and physical lethargy which overtakes even the most hardy at a height such as that. During the 1933 expedition Smythe made a noble effort to climb that last difficult 1000 feet alone. He managed to cross the great snow-filled couloir and saw what he thought was a reasonable route to the summit. But he found the way blocked by newly fallen snow, and an hour's struggle brought an advance of only fifty feet. The hour was late, and he was forced to return to Camp 6 defeated.

Meanwhile the Mount Everest Flight Expedition had succeeded in flying over the summit in specially protected planes, and had photographed the surrounding country. Yet to the heroes who have followed in the footsteps of Mallory and Irvine this achievement, great as it was, scarcely seemed to count as a real 'conquest' of the mountain. So in 1936 yet another expedition made the long trek across the bleak Tibetan plateau to the Rongbuk Glacier and the foot of Mount Everest. Hugh Ruttledge, the leader, was accompanied by a brilliant band of climbers and Nepalese 'tigers'; but once again an unexpected monsoon ruined all chances of victory. There were heavy falls of snow, Shipton having a narrow escape in an avalanche on the famous North Col. This proved the last straw, and after exploring an alternative route to the foot of the mountain the expedition returned home.

Mount Everest is roughly the shape of a three-sided pyramid, and the northern face—the only possible climbing-route—is

linked to the mountain Chang Tse, or North Peak, by the narrow North Col. On either side of this col two great glaciers sweep down, the main Rongbuk Glacier and the East Rongbuk Glacier. The first four expeditions followed the East Rongbuk Glacier and established a camp on the col. Beyond this point, which is reached by climbing a veritable cliff of ice over 1000 feet high, the worst difficulties begin. There is one area where the strata have an outward and downward dip, for all the world like the tiles on a roof. Very often this stretch is covered with a film of ice, which makes it a death trap of terrifying proportions. Higher still there are two precipitous cliffs, or steps of dark rock, which must be climbed unless a difficult traverse lower down the slope is attempted. Then comes the great couloir, a snow-filled channel which splits the mountain almost from top to bottom, where the snow is so slippery that it is almost impossible to get a foothold. Finally, there is the ultimate peak itself, about which little is known, although many climbers believe that in good weather conditions this last lap would not be a tremendous obstacle.

Among this band of optimists may be numbered those who undertook the latest (1938) expedition. This group, which included, incidentally, some of the most experienced mountaineers of our era, wanted to try out a new technique. Previous expeditions had all been on rather a grand scale, with scores of porters and an elaborate commissariat system. This meant that the expeditions were expensive, and it frequently happened that a large number of men were endangered in several different sections of the climb. The latest expedition hoped to prove that better results could be obtained by a small party of first-class men, who would not be unduly hampered by the need for taking care of large numbers of porters making trips from one high camp to the next. Tilman and Shipton had already shown what could be done with such a party at Nanda Devi and in the Karakoram; and, in 1938, a similarly small American party had reached an altitude of about 26,000 feet on the unknown ridges of K2, the second highest mountain on earth.

Tilman's party consisted of seven Europeans and a dozen

Sherpa porters. They arrived at Rongbuk monastery on April 6, which is much earlier than all previous expeditions. Here they were joined by a further contingent of forty-five Sherpas. By this time, however, four of the Europeans were suffering from colds, and Shipton had colic. After the usual ceremonial blessing by the chief Lama of Rongbuk the porters went off and established the first camp near the foot of the East Rongbuk Glacier. It was bitterly cold, and 47 degrees of frost at night were recorded. Camp 2 being set up near the middle of the glacier, it was then decided that as the season was so early and conditions were so bad it was useless to make any further efforts for a time. Moreover, the plague of colds and influenza continued, and on the twenty-seventh Shipton, Smythe, Oliver, and nine men crossed the Lhakpa La *en route* for the milder conditions in the Kharta valley. Since the wind and cold were still just as bad the remainder followed them two days later.

When Tilman returned on May 14 he found that the mountain was covered with snow; on the glacier too there was a foot of snow, and water lay about in pools. However, Odell and Oliver reached the foot of the col, and reported that the snow was in good condition, so the next day a small party began to climb the col. The snow certainly was in good condition for a fair way, but three hundred feet from the top of the slope the angle steepened sharply, and a long traverse had to be made. Oliver led the way with two Sherpas, but before he had gone far the snow avalanched. Fortunately, the line that was being paid out by the rear-guard held the climbers, and they were easily kept steady. Before the day was out a track had been stamped out in the steep, soft snow. During the evening, however, it snowed steadily for several hours, and there was much roaring of avalanches.

Four days later the route to the top of the col was completed, ropes were fixed, and loads dumped on the site of the 1936 camp. But the outlook was not promising. The snow was deep and soft. There were clouds billowing up in all directions, and the mountain was covered with snow. Eventually it was decided that Shipton and Smythe, with half the porters, should go down the glacier, with the purpose of tackling the other

route via the main Rongbuk Glacier as soon as conditions were better.

The conditions on the col remained bad, however, but on the thirtieth of the month Tilman pushed on with one Sherpa as far as 24,500 feet, only to see that it was hopeless to attempt a general assault. In fact, when further snow fell there was a mass retreat to Camp 1.

From this time on the main effort was concentrated on the alternative route via the main Rongbuk Glacier. Tilman joined Shipton's party, and a camp—named Corner Camp—was established about half-way up the glacier. On June 4, in spite of some difficult crevasses and mist, a camp was set up on a snow terrace at the foot of the west side of North Col. From this position conditions looked fairly promising, but the next morning's climb led through the debris of a huge avalanche which had fallen recently. This meant that for five hundred feet the slope was bare ice, and after they had cut steps in this they found that even more had to be made to reach a stretch of snow suitable for setting up a camp.

The next morning further progress was made across a snow-slope that had been swept hard by the wind. Two of the porters were overcome with mountain sickness at about 25,000 feet, and a snowstorm a little later almost led to the abandonment of the effort to establish the next camp at 25,800 feet. Shipton, Smythe, and seven porters spent the night in this camp eventually, and though they were prevented by fierce winds from advancing the next day, they moved up to Camp 6 (27,200 feet) on the following day. This climb was very arduous. The rocks were steep and covered with snow, and it took eight hours to climb 1400 feet to the little patch of scree where the tents were raised. Next day they made an effort to climb diagonally upward, but almost immediately got into deep powder-snow, and, realizing the task was hopeless, returned to the camp on North Col.

On the way down they met Tilman and Lloyd, who were going up to Camp 6. It was agreed that the summit was out of the question under such conditions, but that an effort should be made to reach the summit ridge and work along that as

to the knowledge of the mountain. Tilman and Lloyd reached Camp 6 safely, Lloyd seeming to benefit from the oxygen apparatus he was carrying. That night there was a gale which made the double-skinned tent flap furiously, and the climbers got little sleep. Next morning they started out again, but were soon forced to go back to the tent with numb hands and feet. Two hours later they set off once again, and tried to reach the summit ridge by climbing a steep rock-wall. Four possible lines of attack were tried, but all proved too difficult. In the end Tilman had to give up 200 feet below the summit ridge and about a mile distant from the summit itself.

At Camp 4 they found that the chapter of accidents and illness was still unfinished, and two of the best porters were almost incapacitated. Consequently, a general retreat down the East Rongbuk Glacier was ordered: this ended the 1938 attempt. As before, it had been made abundantly clear that in order to climb the final 2000 feet perfect conditions must prevail. On the other hand, the new technique of small parties had justified itself, since two parties had reached Camp 6 fit and ready to make the final assault had conditions allowed. Incidentally, the expedition had only cost about a quarter of the money usually spent by the larger previous expeditions.

24

KANCHENJUNGA

MANY A weary sahib newly arrived in Darjeeling from the dusty plains of Hindustan has gazed in rapture on the towering, snow-covered peak which dominates the northern view. This magnificent pile is called Kanchenjunga, and though it is some 900 feet lower than Everest it is in all probability the most formidable peak in the Himalayas. Several expeditions have tried to penetrate across those glittering ice-fields, but all have been repelled by the gigantic cliffs and cataclysmic avalanches of the Goliath. Undoubtedly, the most meritorious efforts to reach the summit were made by the expeditions of 1929 and 1931, organized by Paul Bauer.

The expeditions approached the mountain via the Zemu Glacier—one of several ice-fields which flow down from the long ridge with its five summits. Winding along the glacier, they at length came to a mountain basin of vast and overpowering size, which culminated in the ice-mailed pyramid of Kanchenjunga. Beyond the base camp the way led past ice-pinnacles and colossal ice-slabs to a great precipice at the foot of the main ridge. For some time this held up progress, but at length a practicable route for porters was hacked out. Eventually a camp was made on the precipice at just over 19,000 feet. Bauer called it the " Eagle's Eyrie," because it clung to a narrow ledge of rock beneath a huge perpendicular tower. Beyond this point there were several dizzy towers to overcome, and a week passed before they were able to establish the next camp high up on the ridge.

A few feet beyond this camp a wall eighty-five feet high had to be rounded, and then came a difficult hundred-feet ice-tower with an overhanging crest. On the left flank there was a narrow ledge, roofed by huge projecting cornices, which gave access to a deep recess in the ice. Kraus, one of the leaders, wormed his way into this gully and proceeded to cut a vertical shaft with his ice-axe. At long length this staircase

was completed, and so the leaders reached a very dizzy ridge scarcely two feet wide and threatened on both sides by cornices. In truth, they were walking an ice tight-rope with a drop of thousands of feet on either side.

In order to solve the difficulty of establishing camps on the ridge Bauer hit on the idea of digging ice-caves; these took some time to hack out but proved to be warm and comfortable, since they were sheltered from the annihilating winds of the high Himalayas. The entrances were made as small as possible, but the interiors were gradually enlarged by the successive occupants until some could accommodate eight men. The highest ice-cave was made at 23,000 feet on quite open ground, and from this base one party zigzagged their way to 24,256 feet. After weeks of toil it looked as if success were certain. Two more camps were all that was needed to bring them to the final precipices. But Kanchenjunga had not had its last word yet.

On October 4 ominous black clouds filled the sky, and it began to snow. It snowed all next day, and communications between the various supporting camps were broken off. There was a slight intermission on the following day, and the advance-party tried to go ahead from their ice-cave. But it soon began to snow again, and by the next morning the entrance to the cave was snowed up. Bauer found it necessary to keep shovelling the snow away all that day. A howling, icy blast cut through them as they crawled out, and great masses of snow slid off the towers, making a weird crescendo as they hurled into the unfathomable depths far below. There was only one chance of survival, and that was to retreat as rapidly as possible.

Roped together at lengthy intervals, the stumbling climbers left behind them a trench as high as a man. Sometimes the porters with their heavy packs stuck fast in the drifts and had to be pulled out. At any moment there was a danger that the freshly fallen snow would avalanche. Once a great slab did begin to slide and the porters were carried off their feet, but Bauer had sprung to safety on a ridge and, by jerking on the rope and shouting words of encouragement meanwhile, was able to help them to their feet again. At last they all reached

PORTERS OF THE KARAKORAM EXPEDITION AT A HIGH CAMP ABOVE TRANGO GLACIER

[illegible]

From "Blank on the Map," by Eric Shipton [illegible]

KARAKORAM PEAKS

[*See p.* 218.]

From "Blank on the Map," by Eric Shipton (by permission of Messrs Hodder and Stoughton, Ltd.)

the lower ice-caves, and so down the great precipice to the Eagle's Eyrie. This they all gained in safety, although one climber was so badly frost-bitten that he could hardly walk.

In June 1931 Bauer and his faithful band returned to the attack. Kanchenjunga celebrated their arrival by a salvo of clattering avalanches thunder-crashing from the corner pinnacles of the peak. When they reached the terrible precipices at the foot of the mountain (they have an average inclination of 60 degrees) they found that the warm, south-west winds were melting the ice-curtains and causing a barrage of falling stones and snow. Only by advancing in the early morning were they able to begin the climb, and even then a cunning use of shelter was needed. In the worst places the porters jumped from one sheltered spot to the next; the porters and the cook who had been left at the Eagle's Eyrie prayed in terror for their comrades exposed on the side of the precipice when masses of rock came whistling by, to smash like glass as they rebounded off the cliff.

Two months' hard work found the leading party established on the level ridge, although even there it was dangerous work owing to an unexpected rise in temperature which brought rain and melted the treacherous snow bosses. Then an epidemic of colds broke out, and few of the men were fit to work. For several days the leading party lived on a veritable razor's edge. Northward the rock-face fell away sheer as a church steeple, and on the south ice-ribs swept down at an angle of 60 degrees for thousands of feet to the glacier below. Slowly a path was stamped out along the ridge, until at last Camp 8 was established. The path involved a very dangerous traverse into a gully, and on August 9 a terrible accident took place here. Schaller, one of the best climbers, was leading the way for two porters and when they reached the gully the third man secured the rope to a boulder and paid it out as the other two advanced. Suddenly two black forms were seen to fly out into space. Bauer prayed that a miracle might happen and that the rope might hold them. But the rope was not strong enough, and the two fell like a flash through the gully on to the snow

almost two thousand feet below. Later the bodies were recovered and buried on a rock island in the Zemu Glacier.

This terrible tragedy did not deter the heroic climbers, who had agreed earlier that in the event of an accident the work must go on. But now that Schaller had gone there was only one really fit man left, and, in addition, some of the porters were demoralized. Nevertheless, a fortnight after the accident a higher camp had been fixed and they were attacking yet another of the fantastic ice-towers which crowned the ridge. These towers had to be chopped away until a feasible path was opened, and then the party would straddle along the knife edge for a few more yards to the next obstacle. One such tower they named the "Devil's Tower," and another the "Fungus Tower," because it rested on a thin stalk and overhung right and left like a mushroom. This particular tower they did not attempt to climb, but crawled out on to the side of the ridge for some fifteen yards under its projecting roof and so reached the sharp ridge of the col beyond.

At last, however, Camp 9 was set up in an ice-cave, and the great push for the summit began. Two porters volunteered to join the vanguard, but when they reached the place of the accident they suddenly lost their nerve. Peering into the gully they started to pray aloud in terror, and finally, heedless of the steep precipices which cascaded on either side, they threw themselves on the ground and implored the leaders to leave them behind. One of the porters took off his goggles, and so got snow blindness. Consequently, these two men had to be left at Camp 8. Thus with only three porters available Camp 10 was established at about 23,000 feet.

> One lived here upon an almost ethereal platform raised high above the world, and separated from it by vast abysses, while gentle slopes led up to higher regions. Far below mighty glaciers flowed down to the valleys, deep blue lakes sparkled between debris and ice, green moraines reminded us that there still existed flowers and plants in those deep valleys which we had left for over two months. . . .

But by this time most of the leaders were feeling the strain of their herculean exertions. Bauer had strained his heart and was reluctantly forced to turn back from Camp 9. He spent a

dreadful night in an ice-cave a little lower down: there was neither a sleeping-sack nor a blanket, and a concealed crack in the ice had opened out so that a freezing wind blew through the cave. Somehow he managed to survive, and next day dragged his weary steps down to the comparative comfort of Camp 9.

Meanwhile the four leaders had pushed on to the highest peak on the ridge and were preparing to cross on to the main peak. Camp 11—another ice-cave—was cut out of the ice, and the next morning they began to follow the snow *arête* beyond the outpost peak. By balancing carefully they made progress along the side of the precipice, although there was a certain amount of mist. Eventually Allwein, the leader, reached a rise in the ridge and looked through the clearing mist at the next slope. He at once realized that further progress was impossible. The lower half of the slope was curved strongly convex—horribly dangerous for avalanches and quite impassable. Moreover, on the upper slopes there were ominous cracks and great jagged edges where snow-slabs had fallen. On the other side there were overhanging snow masses which threatened to break away at any moment. So, within sight of their goal, the climbers had to admit defeat, and in thick, driving snow began the descent. They had feared that they might meet such a mass of avalanche snow lower down the mountain, but it was indeed a bitter surprise to find that after all their toil along the ridge their efforts had been in vain.

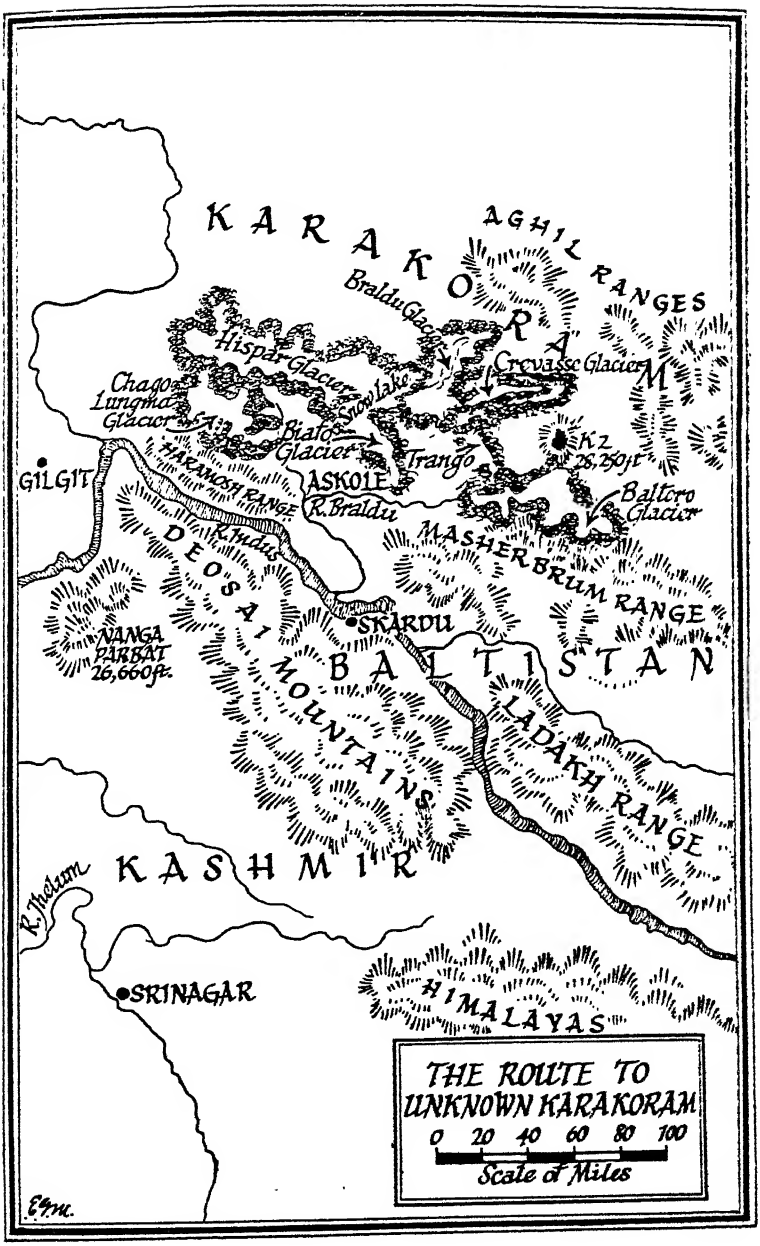
So ended the second great effort to conquer Kanchenjunga, and it may be the last, since the experiences of the expedition seem to suggest that this mighty peak will never be climbed.

25

UNKNOWN KARAKORAM

WHILE RETURNING from the 1936 Everest expedition Eric Shipton was asked whether he had ever considered a journey down the Shaksgam river—a journey which would lead through the heart of one of the largest blanks in the map of the Karakoram in the vicinity of K2, the second highest mountain on earth. Shipton was enthralled by the prospects of such a journey, and asked his old companion Tilman to join him. They decided to set up a base somewhere in the centre of the unknown area to the north of the main Karakoram range; and in order to make the expedition of more value Michael Spender was enrolled as surveyor and John Auden as geologist. Seven Sherpa porters were engaged. They included the veteran Angtarkay, hero of many Himalayan expeditions.

The journey really began at Askole, a Balti village near the mouth of the Biafo Glacier—one of the greatest in this region of giant ice-streams. A hundred Balti porters were hired to carry the supplies, which included enough food to last three months or so. Almost immediately Shipton was faced by a vital problem, that of finding a route across the Karakoram so early in the season. The local coolies soon tired of trudging through the snow or wading across icy glacier streams, and when they found that Shipton was leading them towards a possible pass at the head of the Trango Glacier (which had never previously been crossed) they began to show signs of rebellion. Sudden snowstorms blotted out the sun and made the camps look like something on a Christmas card; and the Baltis huddled together under their blankets in a state of abject misery. Hoping to restore the spirits of his men by finding an easy route, Shipton went ahead to reconnoitre. The outlook was not very bright. A great rock precipice crowned by a hanging glacier appeared to block the head of the valley, and the ridges were covered in soft snow. Shipton climbed a ridge to a height of over 17,000 feet, hoping to spy


KARAKORAM
AGHIL RANGES
Braldu Glacier
Hispar Glacier
Snow Lake
Crevasse Glacier
Chago Lungma Glacier
Biafo Glacier
Trango
K2 28,250 ft.
Baltoro Glacier
GILGIT
HARAMOSH RANGE
ASKOLE
R. Braldu
R. Indus
MASHERBRUM RANGE
DEOSAI MOUNTAINS
NANGA PARBAT 26,660 ft.
SKARDU
BALTISTAN
LADAKH RANGE
KASHMIR
R. Jhelum
SRINAGAR
HIMALAYAS
THE ROUTE TO UNKNOWN KARAKORAM
0 20 40 60 80 100
Scale of Miles
E.H.M.

a pass; but he had to return to camp before attaining his objective.

The following day was fine, however, and good progress was made up the main glacier to a camp at 17,000 feet, beyond which there appeared to be a likely col. Here some of the Baltis clamoured to be allowed to return, and eight had to be paid off. By stamping a track through deep powder-snow the col was reached early next morning. Then, to the dismay of the porters, another and slightly higher col was seen some distance ahead. The majority of them gave up the ghost, complained of sickness, and even lay down groaning in the snow. Eventually all but seventeen had to be paid off, and the provisions were left in a great dump in the middle of the hanging glacier. This unfortunate incident was soon forgotten when two hours later the faithful band reached the second col and looked down the Sarpo Laggo Glacier into the unknown country they had struggled so far to reach. The loads were rolled down the snow-slope, and the men hurried down to the glacier and made a camp near the first rocks on the side of the ice.

A few days later Auden and Tilman (who had been attacked by fever on the southern side of the pass) joined Shipton and Spender in the work of relaying the stores down to the base camp six miles beyond the pass. They found themselves in wild country and there seemed to be no life in the desolate valley.

By June 12 the snout of the glacier was reached, and from this point they could see far up the Crevasse Glacier to the ring of unnamed peaks at its head. That same evening they also found an oasis, and the dark patch of trees provided welcome fuel. From a ridge above this pleasant spot they were able to look down the Shaksgam valley and far into the unknown Aghil Ranges. Shipton spied a wild ass standing beside the river and also was lucky enough to shoot a couple of bharal (mountain sheep).

Base camp having been established, Spender and Auden went off on their scientific work, but before Shipton and Tilman could set off across the Shaksgam river into the unknown ranges beyond there was another rebellion by the Baltis, and this time all but four of them departed up the

glacier. Then Tilman and one of the Sherpas were attacked by fever. However, the next day Tilman was able to accompany Shipton and Spender along the weird valley which was shut in by gaunt limestone cliffs. The river flowed over a series of sand- and gravel-flats, and was at times half a mile wide. They knew that the really dangerous part of this particular journey would be on the return route, when the Shaksgam would be much more difficult to cross owing to the melting of the snows during the summer. As it was, in places the river flowed against the cliffs, thus involving scrambling along narrow ledges until the obstacles were passed. At one point they had to climb up a steep gully, and found themselves faced by a sheer cut-off. Eventually they managed to lower their loads down into the ravine and climbed down themselves on rounded boulders jutting out of the face of the cliff. The cliffs were made of conglomerate, and several chunks fell away with a resounding crash as they gingerly descended.

At length the Aghil Pass was reached, and then the explorers set off to find the Zug Shaksgam river, somewhere beyond the unknown ranges to the east. Good progress was made along a wide, grassy trough running beside a great glacier; and eventually a wide valley was reached, which they decided must be the Zug Shaksgam. However, when they reached the river they found that it was so swollen that there seemed little chance of reaching the far side. Downstream there was an impassable gorge, but by climbing a ridge they managed to approach the stream from a nullah. Soon they came to a place where an overhanging rock forced them to cross to the other side. Although the stream was muddy and swollen, they underestimated its volume, and when Tilman started to ford across he was soon in difficulties. When he did reach the far side his leg was bleeding freely, and he had lost his ice-axe. Shipton threw a rope across, and Angtarkay and one of the other Sherpas started to wade out hanging on the rope. Angtarkay was soon knocked over, and the force of the water wrenched his grasp from the rope. Swept down midstream, the poor fellow was battered on the rocks, and the weight of his sodden load impeded his efforts to stop himself. Just when it seemed certain that he would plunge over a steep drop he

was lucky enough to get caught up on a projecting rock. Shipton and the others ran down to his assistance, and luckily were able to rescue him. Although he was quite exhausted and badly bruised, the hardy porter soon recovered. That night Tilman and one of the Sherpas spent a poor night on the far bank without a tent, and snow was falling when dawn came. By that time, however, the stream had fallen, and soon the whole party were united again.

The upper end of the gorge appeared to be just as impassable as the lower end had been, but in the other direction it was possible to go ahead for about a mile until the river flowed up against the cliffs for about a hundred yards. The Baltis made an amazing effort to overcome the obstacle by crawling like flies along the crumbling conglomerate cliffs, but in the end they had to give in, and it was decided to follow a nullah which climbed 4000 feet to a ridge. Making good progress for a few miles along a terrace, the party rounded a big bend in the Zug Shaksgam, and were able to see that the river joined the Surukwat valley. By this time the terrace had become cut up by mud ravines, which were so slippery that steps had to be cut. Evening came, and a violent gusty wind blew up, making them think it was time to camp. But on this high terrace they had seen no water, and this would mean a foodless night unless they could reach the valley at the foot of the steep cliffs. They tried several ravines, but most of them ended high up on the wall of the terrace. Shipton himself investigated one gully. He found that the ravine gradually narrowed until the walls met over his head and he found himself in a cavern lit from above by a ghostly green light. It was still possible to advance, although by this time the tunnel had become so narrow that it was difficult to squeeze through. His persistence was rewarded finally, because suddenly he found himself on the wide sand-flats beside the river. He ran back as fast as he could, for it was nearly too dark to see. Soon he came to a place where the passage divided, and he could not remember which branch to follow so he had to wait and shouted. When at last he did hear a reply it seemed to come from directly over his head. Tilman had walked along the top of the ravine and had heard his companion shouting.

Soon the whole party had descended by Shipton's route, and they were able to make camp on the river side.

Making their way up the Surukwat valley, the party then returned to the Shaksgam over the Aghil Pass and rejoined Spender's party, who had made a fine map of a large area in the Aghil Ranges. They then made their way back to the base camp, and were much relieved when they found the Shaksgam was fordable. The next day the expedition split up again into parties; Spender went surveying up the Sarpo Laggo Glacier while Auden, Tilman, and Shipton went exploring up the glaciers on the northern flanks of K2. This party climbed towards a wonderful circle of ice-peaks, and from a high ridge had a wonderful view of the stupendous northern face of the mountain, while on the other side they could see into the barren ranges of Turkestan, the maze of peaks at the head of the Crevasse Glacier, and also a new glacier descending from Staircase Peak, K2's massive neighbour. Tilman managed to reach this glacier, and followed it down to the base.

By this time the porters had assembled the stores needed for the second great project of the journey—the exploration of the Crevasse Glacier and the country to the west. In particular they hoped to solve the mystery of the reported "Snow Lake," which was thought to be a great ice-cap, possibly three hundred square miles in area, from which flowed down the Biafo and many other glaciers. So far nobody had stepped on to Snow Lake, although several explorers had seen it in the distance. Dr Visser, for instance, thought that the Virgerab Glacier had its origin in the Snow Lake.

Two dumps had been established on the glacier by July 21, and so far good progress had been made. Then they had to make their way through a jumble of pinnacles and crevasses caused by the junction of the Crown Glacier. In one place the way was barred by a wide stream flowing down the glacier. It had cut such a deep trough and was flowing so swiftly that there was no chance of fording it. At length they found a spot where the stream was crossed by a remarkable bridge. In order to reach this they had first to climb through a tunnel in the ice and then to cut steps spirally upward while the torrent raged through the icy canyon fifty feet below.

A little later on they were held up for five hours by another stream, and though they found an ice-bridge it led them into a cave twenty feet high from which there was no exit. Meanwhile one of the Sherpas had found a place where the near wall of the ravine overhung the river, and he thought he could reach the other side by leaping to an ice-cliff. It was a long jump, with only a narrow ledge on the other side on which to land: a slip would mean a nasty drop into the icy torrent at the bottom of the canyon. The Sherpa insisted on making the attempt, but when Shipton had tied a rope round his waist he kept walking to the brink and back again. At length he made the leap, landed on the ledge, swayed dizzily for a moment, and then, recovering his balance, was able to climb to the top of the ice-wall. It was then a comparatively easy task to fix up a treble rope and to haul the loads across.

A little farther along another stream was crossed by leaping from one overhanging ice pinnacle to a corresponding one on the other side, and so they gained a high ridge of moraine along which they made good progress. Camp was made on a stretch of soft sand beneath the cliffs. This was not a particularly good site, since there seemed to be a good chance of being bombarded by stones from the rotten crags above, but it looked more comfortable than the broken ice of the glacier itself.

It was now August 1, but there was still a good supply of food left and it was arranged that once again the expedition should split up into parties. Shipton was to make his way from the head of the Crevasse Glacier, through the northern ranges to the Shimshal Pass; Tilman was to go westward in search of Snow Lake, while Auden was to go southward to the Panmah Glacier.

The next few days were spent in reconnoitring the saddles at the head of the glacier, and it was on one of these expeditions that Shipton had an alarming experience. Accompanied by Angtarkay, he had succeeded in reaching the far side of a pass which gave access to the large glacier systems of the Shimshal area. A blizzard delayed them on the way back, and as it grew darker they ran madly down the ice-slope towards camp. There were plenty of crevasses about and

suddenly Shipton felt the ice give beneath his feet, and he fell into space. The fall was checked by the rope, which pulled him up with a painful jerk. He found that he had fallen into a crevasse just wide enough for him to get his feet against one ice-wall and his back against the other. Using the usual 'chimney' manœuvre he was able to climb for a short way, but in the dark he put his foot on an icicle which gave way and down he fell again, this time into the deep lake at the bottom of the crevasse. There were several bits of loose ice floating about, but nothing on which he could get a purchase. By this time he was half frozen and very exhausted. Just at the critical moment he felt a lump of ice sticking out from the wall a few feet above the water, and with a struggle he was able to hoist himself out of the water. Fortunately, Angtarkay had a spare rope, and he lowered this in such a way that Shipton was able to slip his foot into a loop, and so at last, with a great deal of difficulty, was rescued from his perilous plight.

One night a few days later they had cause to regret their choice of the camp site. There were several ominous crashes as large boulders began to fall off the cliff. It was snowing hard and pitch dark. They were just discussing the situation when there was a prolonged rumbling followed by an explosion like a clap of thunder within a few yards of the tent. For a moment Shipton feared that the Sherpas had been wiped out, and was relieved when he heard them shouting and laughing. There was nothing for it, however, except to shift the camp on to the ice-hummocks of the glacier, out of range of the rock bombardment.

On August 12 Tilman set off on his search for a way to Snow Lake, making his way over a pass in a blizzard. This brought him on to one of the high tributaries of the Braldu Glacier, and after crossing yet another pass he reached a large *névé* field about four miles wide, which was evidently the upper basin of the Biafo and a part of the reported Snow Lake. Although he was disappointed to find the so-called ice-cap was so small, he was thrilled to find the tracks of an 'Abominable Snowman' between two feeder glaciers. The tracks were eight inches in diameter, eighteen inches apart, and almost

circular in shape. The strangest part about the whole business was that the tracks were in a straight line. They were about a foot deep, and ran from a glacier pool to some rock about a mile away. The next day, moreover, they picked up the same spoor on the north side of Snow Lake. The Sherpas said that this was the smaller type of Snowman, and that he fed on men. Tilman was much puzzled by the whole affair. They were certainly not bear tracks, nor indeed did they suggest any kind of known animal or bird.

From Snow Lake, which appeared to be about twenty square miles in area, Tilman made his way down to the main Biafo Glacier, and then spent some days investigating the famous Cornice Glacier, which was supposed to be totally enclosed by mountains. After some prodigious feats of mountaineering he managed to reach the glacier, and sure enough the valley seemed to be blocked up by a high ridge. However, much to his disappointment, the glacier terminated in a nullah, through which the glacier stream flowed to join the main Basha valley. So Tilman had exploded two old legends, but had found some evidence to support those who believed that most amazing of all the Himalayan legends—the Abominable Snowman.

Meanwhile Shipton and Spender had crossed a high pass into the Braldu valley, and on August 20—after a month of glacier travel—reached ' dry land,' where there was grass and wood-fuel. Then began the important work of mapping this great unknown valley. This work accomplished, the party set off down the Braldu river towards the nullah which leads to the Shimshal Pass. As they rounded a willow thicket they were amazed to see a horseman riding along. This was the first human being other than members of the expedition that they had seen for three and a half months. The native was friendly, and made them understand that he had been working a salt deposit lower down the valley. Then he went off and brought his three companions, who had four yaks. Conversation was difficult, since nobody could speak their language, but eventually it was arranged that one of the natives should ride across the Shimshal Pass to fetch provisions while the others conducted a party down to the junction of the Braldu

with the Shaksgam river. This journey completed the surveying programme, and with the arrival of a party of Shimshalis, under their Lambadar, the expedition once again came into contact with the outside world.

26

EXPLORING THE HEIGHTS AND DEPTHS

THE BATHYSPHERE

FROM THE time when Plato told the story of the lost continent of Atlantis men have always wondered what mysteries lie unrevealed beneath the ocean deeps. Is it true that there are the remains of buried civilizations on the ocean floor? Is it true that there are strange forms of nightmare phantasy swimming about in the colossal pressures which must exist a mile or more down? So far little more than the fringe of this interesting field for exploration has been touched. Ever since the classic expedition of the *Challenger* seventy years ago oceanographic work has been going on, but even now we have only the broadest outlines of the shape of the bottom of the oceans. Similarly, although a great deal of information has been garnered by the deep-sea trawls and automatic water-gauges of such ships as *Discovery II*, very little is really known about the inhabitants of the great abyss. It is a rare event for a new animal—like the okapi—to be found, but half a mile down there may be entirely new and possibly gigantic forms of life which would make even the Loch Ness Monster seem commonplace.

Only one small area, off the island of Nonsuch, in Bermuda, has been adequately investigated. We owe these discoveries to the ingenuity and courage of William Beebe, of the New York Zoological Society. For some years he was satisfied with the wonderful hauls by deep-sea nets in the small area he had chosen, since he discovered many fish and crustaceans new to science and an equally large number of creatures so strange in appearance that they out-horror all the dragons of medieval romance.

A mile beneath the surface there is a total absence of light, an absolute silence, and an all-encompassing pressure of a ton on every square inch. Yet this unbelievable region is inhabited

by creatures specially adapted to their environment. Some of them have long tentacles, or feelers, which take the place of eyes. Others have become lantern-bearers, and the coloured fire glowing on their sides enables them to recognize their kind. Yet other species carry with them searchlights on their tentacles or foreheads which they can flash off and on as they wish, to signal to their mates with telescopic eyes. The various kinds of dragonfish, for example, have as many as one hundred and ninety light-organs strung along the sides of the body, and on the cheek a large oval organ giving forth a yellow glow tinged with pink. They have clear blue eyes, and needle-sharp fangs so long that they fit into tunnels in the skull. There are snails dashing about with shells as delicate as silk, in spite of the huge pressures. There are fearsome squids, with gigantic eyes, which shoot through the abyssal darkness and suddenly unravel their slender tentacles to grasp their prey.

Dr Beebe eventually decided that he would make an effort to see for himself the habitat of these wonderful creatures. He was already an experienced diver, but even in the strongest of modern diving-suits it is not possible to reach a greater depth than five hundred feet; and so he determined to obtain some sort of diving-chamber, or bathysphere, so strong that it could resist the great pressure of the deeps, and from this vantage-point he would be able to look out into the abyss.

At last the bathysphere was complete. It was four feet nine inches in diameter, weighed about two and a half tons, and had steel walls an inch and a half thick. The chief difficulties were the windows and the hole for the electric cables. Eventually fused quartz three inches thick was fitted into small steel projections. These windows were not only wonderfully clear, but during the actual dives never leaked a drop. The hole for the cables was fitted with two metal glands, between which was placed special packing tightened into place by means of wrenches. The cable contained two telephone wires and two wires for electric light.

The door was a four-hundred-pound lid fitted on to ten large bolts, and once the passengers were inside the nuts were hammered into place with sledge-hammers. The sphere was lowered by a cable of steel seven-eighths of an inch thick, with

a breaking strain of twenty-nine tons. The vital question of air-supply was solved by installing oxygen tanks with automatic valves, together with trays containing calcium chloride for absorbing moisture and soda-lime for absorbing the carbon dioxide. This meant that the sealed globe could keep two people alive for eight hours without any fresh air entering. In addition, of course, it was necessary to have a large and well-organized party of assistants on the barge from which the bathysphere was to be lowered.

In June 1930 the sphere was lowered on an experimental trip with a cine-camera inside. At a depth of 1500 feet the film was exposed electrically, and then the sphere was hauled up. There was nothing on the film, the windows were intact, and only a quart of water had collected on the bottom. Dr Beebe and Otis Barton—the constructor of the globe—decided to try a trip, and were soon curled up uncomfortably on the cold, hard bottom of the globe. With an infernal racket the door was hammered into position. Then silence, and the oxygen valve was turned on. Slowly the sphere was lowered, the hull of the barge came into view, then the green light in the sea began to fade. At three hundred feet Barton made a sudden exclamation and pointed to a slow trickle of water beneath the door. About a pint had already collected. But Beebe was confident that the door was solid, and signalled for a quick descent. This would mean an increase in the inward pressure and a consequent tightening of the door. Soon seven hundred feet was reached, and the trickle had stopped.

At this depth the searchlight was visible as a pale shaft of yellow piercing the deep blue of the water. Then slowly they began to descend again to the region of absolute blackness, until at length the information came down the telephone wire that a depth of eight hundred feet had been reached. Beebe decided not to chance his luck any farther on this first trip, although so far as he could tell the bathysphere and all its equipment was behaving perfectly. An hour after starting they were back on deck again, listening to the hiss of the escaping compressed air as the last of the bolts holding the door was unscrewed.

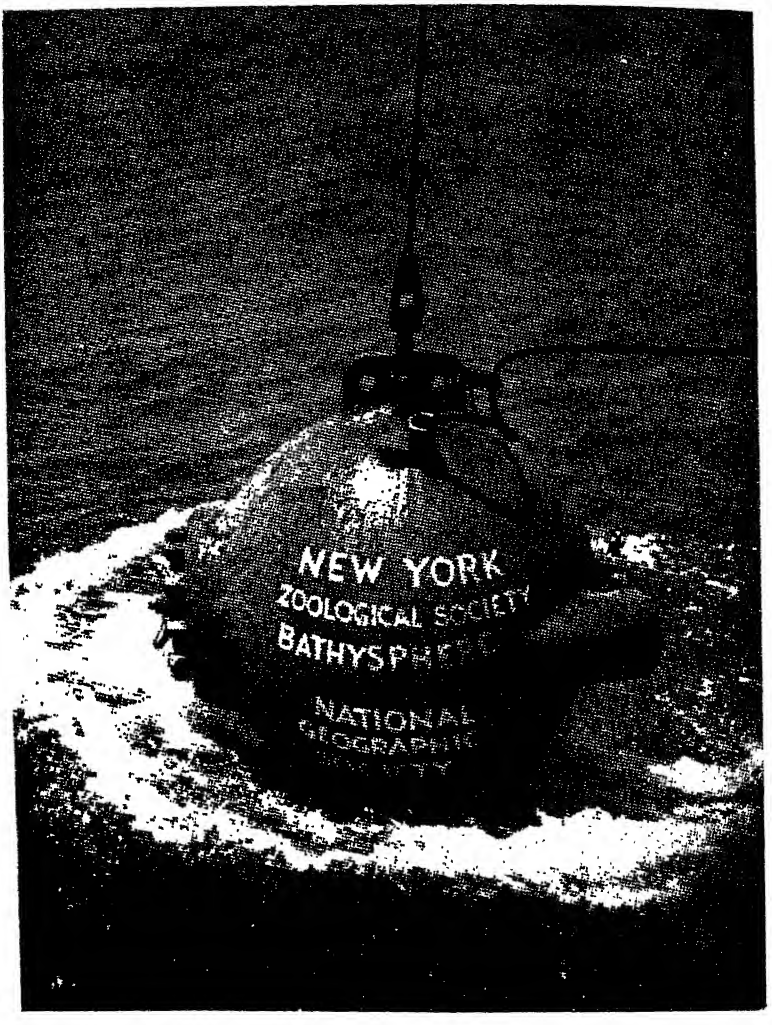
A few days later Beebe and Barton made a deeper dive,

Clearing the Ventilating Shaft after a Storm

A Member of the Scientific Expedition at Mid-ice

(See p. 134)

From "Mid-ice," by J. Gwyn (by permission of Messrs. Kegan Paul, Ltd.)



THE BATHYSPHERE COMES UP

[*See p.* 224.]

Photo David Knudson

From "Half-mile Down," by William Beebe (by permission of Messrs John Lane, the Bodley Head, Ltd.)

and reached a depth of 1426 feet, or well over a quarter of a mile. This time they took a chance on everything being in good order, and entered the globe without a trial submergence. In order to attract deep-sea fish they had baited a number of luminous hooks, which dangled just outside the observation windows. This time they took with them a spectroscope, and noticed the gradual fading of the colours under water. At eight hundred feet there was nothing visible but a pale line of greyish-white, and outside the window the sea looked the deepest, blackest blue imaginable. Beebe sat by the window taking notes of the various forms of sea life he could see and keeping in constant touch by telephone with the barge. At four hundred feet he began to see lantern-fish and other deep-sea forms which he had netted but which he had never before seen alive. Big bronze eels came nosing at the bait, and hovering in the distance he caught a glimpse of strange, ghostly dark forms. At 1000 feet there was a moment's excitement when a loop of black sea-serpenty hose swung round before them, and almost at once they noticed that the sparks of luminous fish began to be abundant.

A few feet lower the searchlight was turned on, and for the first time in history the life of the depths became visible. The first view was of a swarm of silver hatchet fish, whose lights were visible in the blue-blackness on either side of the beam. Then a new species came into sight, then three squids, and then more hatchet fish. Forty-four minutes after leaving deck the lowest level was reached, and Beebe calculated that at this depth the pressure of the water on the bathysphere was equal to 3366 tons. Then the return trip began at the rate of thirty feet a minute, and when at last surface was reached the air inside was still perfectly fresh.

Dr Beebe next made experiments in contour diving with the bathysphere. The barge was brought as near to the coral reef as possible, and the globe was lowered to within two fathoms of the bottom while the boat drifted slowly seaward. Actually this work was more dangerous than deep-diving, and in 1932 the bathysphere almost came to grief. The globe had already been lifted over two low coral reefs, and as Beebe was observing a group of large fish a dark shadow fell across the

window. He looked up, and saw that they were drifting rapidly towards an enormous crag towering fifty feet or more above them and covered on its perpendicular slope with sharp hooks and snags. As quickly as possible he sent out a signal to be hauled up as rapidly as possible. As they ascended the sphere swung nearer and nearer to the cliff, and soon they were close enough to see all the details of the sea-anemones on it. Fortunately, the steam winches worked perfectly, and the globe just cleared the summit, although the wooden base brushed the plumes on the reef-top. On the other side of the ridge Beebe discovered an ancient beach—the Ice-Age shore of Bermuda—and beyond that an awful drop into a black abyss. Thus, in spite of his thrilling escape, he thought the experiment was well justified.

In August 1932 the bathysphere was prepared for a further deep-sea dive, and the globe was lowered on an experimental trip to 3000 feet. As soon as she came to the surface it was clear that something had gone wrong. Looking through the window, Beebe saw that it was almost full of water, while all the air inside had been compressed into a small space. As the giant wing-bolt on the door was loosened a high singing came forth, and then a fine mist shot out like a needle of steam. Beebe ordered the deck to be cleared, since it was obvious that the contents of the bathysphere were under terrific pressure. Carefully, little by little, the wing-bolt was turned, and the hissing noise gradually went higher up the scale. Suddenly, without the slightest warning, the bolt was torn out of their hands, and the mass of heavy metal shot across the deck like a shell from a gun and sheared a half-inch notch in a steel winch thirty feet away. This was followed by a solid cylinder of water with enough force behind it to decapitate anybody. At length the eruption subsided, and afterwards they found that they owed this striking demonstration of deep-sea pressures to a fault in the packing around one of the windows.

The window was removed and replaced by a steel plate, but the nuts on this were tightened only with a monkey wrench, so that the next trip also had a similar result, although this time the explosive mixture of cold air and water was if any-

thing even more powerful. The plate was bolted on again, and the nuts forced home, and this time the globe was lowered to 3000 feet without incident.

Three days later Beebe and his companion entered the sphere, hoping to reach a record depth and at the same time broadcast over the wireless their impressions of life half a mile down. Once again as they descended they observed many strange forms of life, and before long they had passed their record depth. At 1700 feet it was as black as Hades, and all the instruments showed that they had passed entirely beyond the limits of sunlight, yet there were still plenty of dancing lights and new forms of fish to be seen when the searchlight was turned on. At about 2000 feet the sphere began to pitch as the ship rolled overhead, and for a horrible moment, as the explorers bumped their heads against the sides, they wondered if they had broken loose. The telephone soon reassured them, however, and they began to take photographs of the luminous sparks outside the window. Indeed, at this depth they were astonished at the bewildering number of luminous fish which were swimming about. They were amazed, too, at the great activity of all the creatures as they darted and twisted in bewildering swarms. However, at 2200 feet the pitching of the bathysphere had become so bad that the chemicals were being tossed out of their racks, and the men had to cling tightly to the bottom to prevent nasty bruises. The signal for ascent was therefore given, and almost immediately afterwards Beebe saw some large six-foot fishes with a row of strong lights along the side. He named this new fish the Untouchable Bathysphere fish in honour of the record dive.

For the next year the bathysphere was exhibited at the Chicago Hall of Science—very appropriately beneath Professor Piccard's gondola. Then in 1934 it was reconditioned again, and this time the bathysphere was lowered to 2500 feet, remaining there for half an hour. The scientists had been imprisoned for three hours when at last the deck was reached again. A few days later they made an even more daring descent—to 3000 feet, which was almost the full length of the cable. Whilst Beebe was recording that the pressure here was

well over half a ton on every square inch of the globe he heard a metallic twang through the phone. Later on he found out that one of the guy-ropes used in spooling the incoming cable had suddenly broken with a terrific report, and had given everybody on deck a ghastly shock, until they realized that it was a rope and not the main cable. Beebe himself clearly summed up his impressions of this, his deepest dive, in the words:

> The only other place comparable to these marvellous nether regions must surely be naked space itself, out far beyond atmosphere . . . where the blackness of space, the shining planets, comets, suns, and stars must really be closely akin to the world of life as it appears to the eyes of an awed human being, in the open ocean, one half-mile down.

THE STRATOSPHERE

Although there still remain quite considerable areas of the earth which have not been explored, scientists are already talking of the time when investigations will be carried out in the deeps of the ocean, in the mysterious upper atmosphere, and even as far afield as the moon and the planets. Modern advances in physics have extended the range of man's activities very considerably both upward and downward during the last few years. A few years ago a diver could only descend a score of fathoms or so into the sea, but already men have delved well over half a mile beneath the surface of the ocean. Similarly, a few years ago it was thought impossible for a man to rise even as high as Mount Everest, but now scientists are looking forward to the time when there will be regular air routes in the stratosphere at a height of over seven miles.

Although for scientific purposes the sounding balloon has played at least as important a part as the manned balloon, it is clear that there are many advantages about the latter. Sounding balloons have reached the record height of twenty-three miles, but however accurate the instruments they contain they cannot entirely replace the evidence of the human mind. The manned balloon has also advantages over the stratosphere plane since it has little vibration and can reach greater heights

—the respective records at the moment being for aeroplanes 56,017 feet (Lieutenant-Colonel M. Pezzi, Italy, 1938) and for the balloon the ascent to 72,395 feet (13·71 miles) made by Captains Stevens and Anderson of the U.S.A., in November 1935.

The pioneer of stratosphere exploration was Professor Auguste Piccard, of Brussels University. He was primarily interested in the mysterious rays called cosmic rays, which bombard the earth from outer space and which may be caused by the breaking up or creation of atoms in the sun. These rays have far greater penetrative powers than X-rays, but they are largely absorbed by the earth's atmosphere; it was calculated that they would be most intense at a height of about fifteen miles. Piccard hoped, and as the event proved, justifiably, that by connecting an ionization chamber with an amplifier he would be able actually to hear the cosmic rays as they "rattled down on the gondola."

Professor Piccard was thus not so much interested in breaking records as in the physical problems involved in constructing a floating laboratory and a balloon which would carry it to a height above the tropopause—the line which demarcates the ordinary atmosphere from the even-temperatured stratosphere. This line, or zone, is about seven miles up in a region where, as the scientist Glaisher found in 1862, the temperature is well below zero, and where breathing in an open gondola is almost impossible. Actually Glaisher, at a height of seven miles, lost the use of his limbs, and his companion had to pull the rip-cord with his teeth since his hands were frozen.

Piccard solved his problem by constructing a gondola which could be hermetically sealed so that the rarefied air could be kept out. The cabin contained an apparatus for regenerating the air by releasing oxygen, and at the same time absorbing carbon dioxide with chemicals. Since weight was an important factor, the gondola had to be made of aluminium an eighth of an inch thick, and it was seven feet in diameter. Into this fragile sphere all the scientific instruments had to be packed and so arranged that the two passengers could move freely. Two man-holes were fitted, and also eight small circular windows for observations.

Since the total weight of the loaded gondola was about eight

hundred and fifty pounds a very large balloon was needed —indeed, in order to reach the desired height it would have to be about twice the size of any previous balloon. Fortunately, funds were available from a Belgian scientific society, and the balloon was christened the F.N.R.S., which are the initials of this society. It had a cubic capacity of 14,000 cubic metres, and when inflated was about one hundred and eighty feet high. The envelope had a belt sewn on a quarter of the way up, and the gondola was suspended from this in such a manner that the usual heavy net was not required. It was calculated that the balloon would only have to be inflated with hydrogen to one fifth of its capacity so that the gas might have room to expand without escaping from the appendages, and so that a state of equilibrium would be reached at about eight and a half miles. Lead ballast could then be dropped, and this would allow for a further ascent of two miles.

Augsburg, in Bavaria, was chosen as the first starting-point, because it was a long way from the sea but near the factory where the envelope was made. By September 13, 1930, all was ready. Professor Piccard and his assistant, P. Kipfer, ordered the envelope to be inflated, and were just preparing to start when a wind sprang up which blew the balloon to one side, making an ascent impossible. It was therefore decided to empty the balloon. This apparent failure aroused the humourists of the popular Press, who represented Piccard as the typical absent-minded professor who had made an error in his calculations so that the balloon only rose ten feet instead of ten miles.

The professor had to wait until May of the next year before suitable weather arrived, and then on May 27, just before dawn, Piccard and Kipfer entered the gondola. They wore curious-shaped helmets, or shock absorbers, of basket work which served the dual purpose of saving their skulls and also housing certain delicate instruments. In their excitement they forgot to take their flask of mineral water, with the result that when the temperature rose to over a hundred degrees they were assailed by thirst and had to be satisfied with the moisture that condensed on the walls. Once again the wind had interrupted operations, and the gondola was thrown from its

vehicle and sustained slight strains which almost proved disastrous.

However, Piccard refused to be delayed. The man-holes were sealed up, and almost before the passengers were ready the balloon had shot upwards on its journey. Its initial speed was tremendous, and in twenty-five minutes it had reached a height of over eight miles, travelling at an average speed of twenty miles per hour. As the crowd of spectators watched it rise they saw its shape change from that of a gigantic yellow pear to an amber ball which gradually dwindled until it was no more than a pinpoint of light.

The sudden jerk on leaving the ground had further strained the gondola, and for the best part of an hour Piccard was busy struggling to make the thin walls air-tight. His first job was to fix an electrostatic sounding instrument into a one-inch hole in the floor of the cabin. The hole was in such a position that this could not have been done when they were still on the ground. But he found that the aluminium was so warped that he could not get the instrument in the hole. The altimeter soon read 15,000 feet, and the air in the cabin began to escape. Before long the cabin would be quite useless, as the exterior air was becoming more and more rarefied. Kipfer came to the rescue, and with a vigorous effort succeeded in jamming the instrument into place, but at the same time breaking it so that they could still hear the whistle of the escaping air. Emergency measures had to be taken at once. Small quantities of liquid oxygen were poured on to the floor of the cabin to increase the internal pressure, while Piccard hastily smeared a mixture of oakum and vaseline around the leak. Bit by bit he succeeded in stopping the leak until at last the whistling ceased.

Piccard now had time to glance at the barometer, which registered a pressure of 3·2 inches, indicating a height of over nine and a half miles. Kipfer meanwhile was busy trying to restore some order among the instruments which had been scattered all over the place at the take-off. Inside the cabin it seemed to be snowing, for the increasing heat of the sun detached the hoar-frost which had collected on the roof, and it was showering down. Then at a height of ten miles Piccard

took a look out of the windows into the stratosphere. The sky was a deep violet shade—almost black—though the sun seemed to be brighter than at sea-level. Ten miles below he could see forests, rivers, and fields, and the towering summits of the Alps, looking like the miniature reproductions of a museum. He calculated that a quarter of a million square miles of land lay stretched out before his eyes.

He decided on a further ascent, and the discharge of ballast took them a fifth of a mile higher. A little later the alarming discovery was made that the valve rope was entangled among the lines which attached the gondola to the balloon. As the envelope was still expanding under the influence of the sun, and so altering the position of these lines, they feared that the rope might be pulled automatically, causing a too-rapid descent. Once again they decided to release ballast and rose still higher. The heat of the sun became still greater, until a temperature of 104 degrees was registered. This was due to the fact that Piccard, anxious to protect himself from the low temperatures of the stratosphere, had painted one side of the gondola black to absorb the sun's rays. The other side was left shiny, and there was a mechanism provided so that the two sides could be shown alternately to the sun, thus regulating the interior temperature. But the explosive start-off had caused a short-circuit in the motor, and the gondola would not turn. Worse still, the excessive heat was deforming the rubber joints of the manholes, so that air was leaking again.

After a voyage of about six hours Piccard decided to pull the valve rope and so gradually descend. But first of all the rope had to be disentangled, and while he was trying to do this the rope broke, and the frayed end dangled out of reach. They were now prisoners, and had to wait the turn of events. With careful use the oxygen would last until sunset, and then as the gas cooled they would begin to descend. Meanwhile the heat was intolerable, and so some of their clothes were discarded. Then an appalling discovery was made. In the struggle to detach the valve rope a barometer had been broken, and drops of mercury were falling on to the aluminium floor. Since mercury rapidly eats its way through aluminium there was a terrible danger that the floor would collapse, or

at any rate begin to leak rapidly. By great luck the aluminium had been coated with varnish, and this wafer thickness, which kept the mercury from the metal, was all that saved the explorers from almost certain death.

In the afternoon as the balloon slowly drifted over the Bavarian Alps the gas cooled, and they began to descend about a hundred feet an hour. The moon rose, and very slowly the sun curved down into the west. By eight in the evening they had sunk to a height of seven and a half miles. As the sun set the rate of descent increased rapidly, and fifty minutes later they were only two and a half miles up, so they opened the manholes. Below them the giant pinnacles of the snow-clad alps pierced through the clouds, but they had at least been spared from asphyxiation. Good fortune followed them still, and by a careful use of ballast they avoided the surrounding peaks and crevasses, and when Kipfer pulled the rip-cord the balloon subsided on to the flat part of a glacier at an altitude of a mile and three quarters, near Ober-Gurgl village. They camped there for the night, and next day scores of men on skis came out to tow the gondola down to the village.

The following year Piccard made a new ascent in a fresh gondola from Zurich. This time all went well, and a height over ten miles was reached before the descent near Lake Garda. Valuable scientific data were obtained and cosmic rays observed.

During 1933 a Russian stratosphere expedition was organized. The balloon was almost twice the size of Piccard's and carried wireless, so that communication with the ground was maintained. The difficulties of the take-off were lessened by using two small captive balloons which hovered round the gigantic envelope, disentangling ropes and looking for leaks. The starting-point was Moscow, and within an hour the balloon, carrying Prokofieff and two other scientists, had reached a height of ten and a half miles. It remained in the air for seven hours, reached the record height of eleven and a half miles, and descended safely about fifty miles away from Moscow, with all its instruments and records intact.